7TH TIER

Contractors and Engineers Monthly

DECEMBER 1934

Bridges

Lubrication

Paving

Welding

Tunnels

Ten-Wheel Truck-Mixers Made Fast Trips from Aggregate and Batching Plant on Bay State Paving Job
See Page 21

PUBLIC LIBRARY

Features of 1,328-Foot Concrete Bridge

•

Successful Experiment in Tar Road-Mix

•

Jumbos Set Tunnel Record

The telfax system of tape marking wire rope is

Williamsport's

protection to the construction industry

It's a simple matter to get fooled on Wire Rope—unless the grade of steel is definitely labeled. That is why the Telfax Tape System of marking is really the only real protection from error or possible substitution.

Every foot of Williamsport rope contains a tape throughout the core on which is plainly printed the kind of steel used in its manufacture. No other Wire Rope contains this protection.

Have you tried our new "Form-Set" Wire Rope? It's the newest idea in Preformed wire rope made the Williamsport way of Williamsport quality. If you use Preformed Wire Rope you'll like Williamsport best. Let us tell you why. Our engineering department has been a great help to Wire Rope Users. Let them solve your problems.

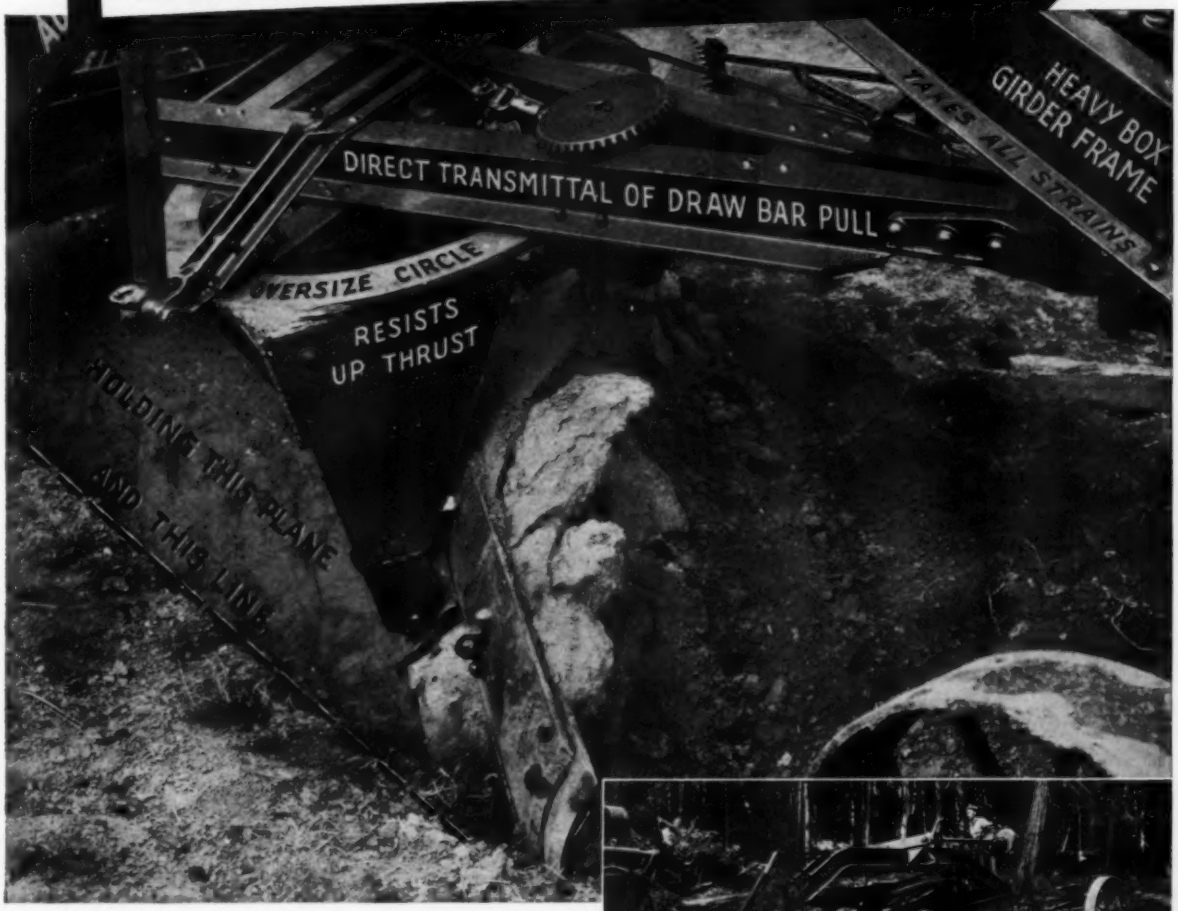
No obligations.

WILLIAMSPORT WIRE ROPE COMPANY

Main Office and Works:
WILLIAMSPORT, PENNA.

Branch Sales Offices:
122 SO. MICHIGAN AVE., CHICAGO

Every Engineering Principle CONCENTRATED *on* THIS RESULT!



● The Austin Blade Grader is built of engineering principles and steel. In its design it was fully as important to select the right principles as to use the right materials. For, when any machine goes on the job it meets the final practical test of everything in it.

Thus, we offer no other argument for the engineering of the Austin Blade Grader but its daily performance on countless jobs all over the world. Some of the principles which account for superior operation are demonstrated before your eyes in the illustration above. All of them can be explained in detail, on request, in preparation for your next selection of a blade grader. Send the coupon for a descriptive bulletin.

The Austin-Western Road Machinery Co.
Home Office: Aurora, Ill. Cable Address: AWCO, Aurora
Branches in Principal Cities

NRA

The Austin-Western Road Machinery Co.
Y, Aurora, Illinois
Send me complete information on the new 8'□, 10'□, 11'□, or 12'□ Austin Grader.
Name.....
Address.....
City..... State.....

ROAD GRADERS · MOTOR GRADERS · ELEVATING GRADERS · DRAGS

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DUMP CARS

CRUSHING AND WASHING PLANTS · SWEEPERS AND SPRINKLERS · SHOVELS · CRANES · ETC · SNOW PLOWS

Please mention CONTRACTORS AND ENGINEERS MONTHLY—it helps.

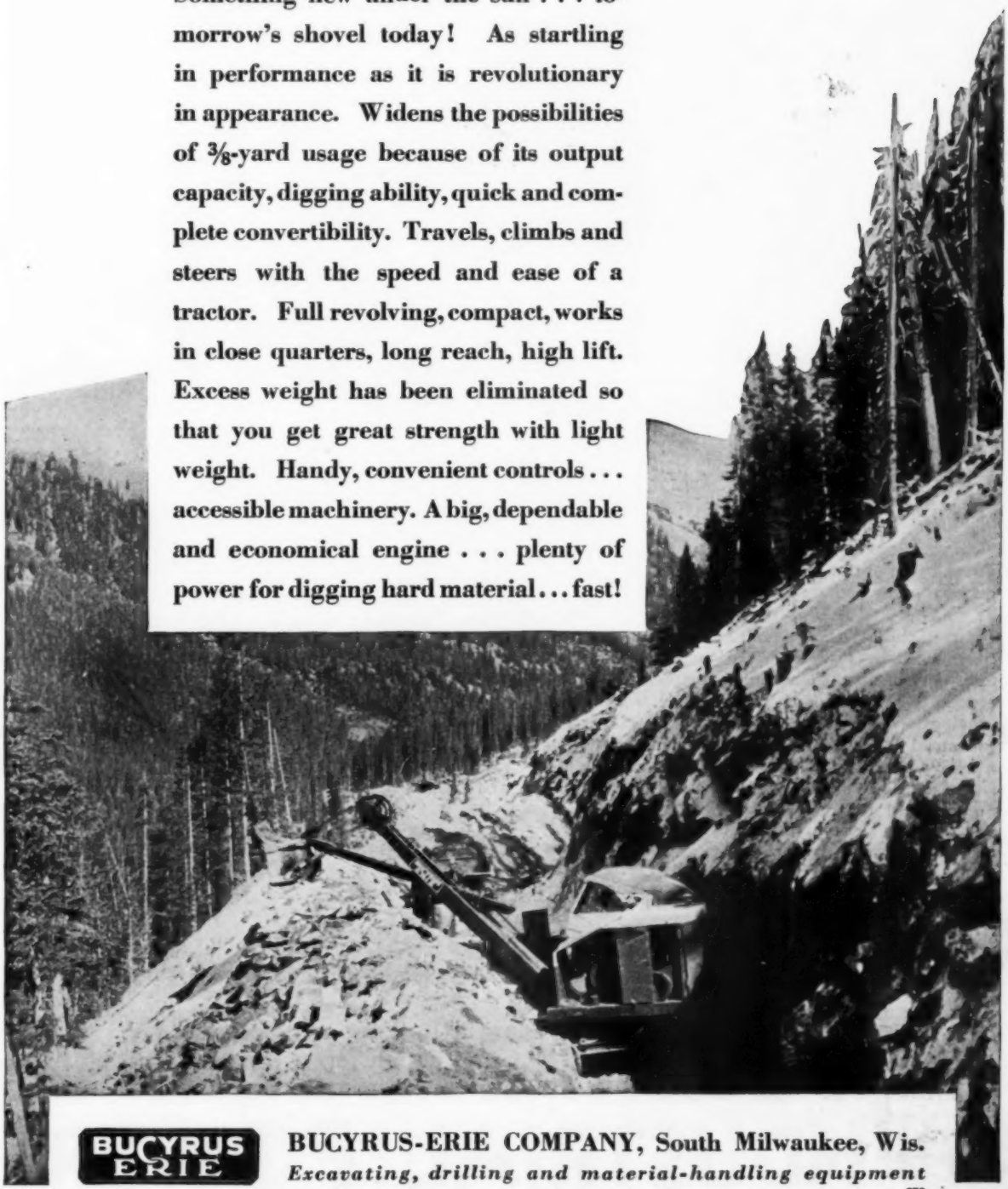
● Rugged . . . Dependable . . . Economical — these are the keywords of Hercules' success. Today Hercules Diesel Engines, like all Hercules Engines, are carrying on this tradition faithfully by delivering reliable, economical power.

HERCULES MOTORS CORPORATION, CANTON, OHIO, U. S. A.

MANUFACTURERS OF HEAVY-DUTY INTERNAL COMBUSTION ENGINES AND POWER UNITS FROM 6 TO 200 HORSEPOWER

For 3/8-yard performance you can't beat the 10-B

Something new under the sun . . . tomorrow's shovel today! As startling in performance as it is revolutionary in appearance. Widens the possibilities of 3/8-yard usage because of its output capacity, digging ability, quick and complete convertibility. Travels, climbs and steers with the speed and ease of a tractor. Full revolving, compact, works in close quarters, long reach, high lift. Excess weight has been eliminated so that you get great strength with light weight. Handy, convenient controls . . . accessible machinery. A big, dependable and economical engine . . . plenty of power for digging hard material . . . fast!



BUCYRUS ERIE

BUCYRUS-ERIE COMPANY, South Milwaukee, Wis.

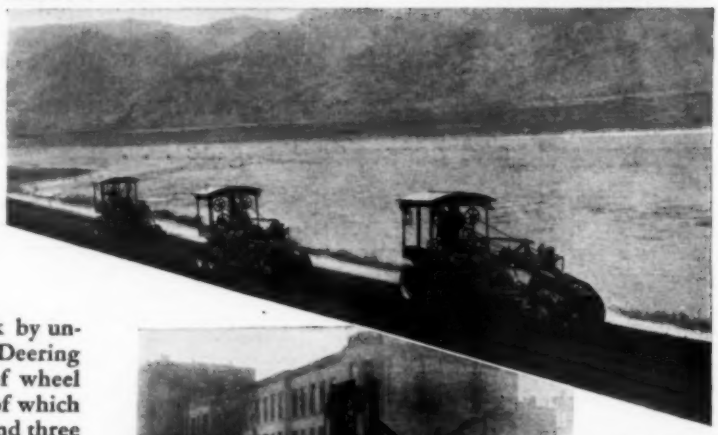
Excavating, drilling and material-handling equipment

830

Do you mention the CONTRACTORS AND ENGINEERS MONTHLY when writing? Please do.

Built to Stand the Gaff on the Toughest Kind of Jobs

A McCormick-Deering T-40 TracTracTor powered by a Diesel engine pulling a revolving scraper on a new section of the Long Lake-Manchester Highway near Seattle, Wash. This outfit is owned by R. Stone, contractor on this Federal project.



McCORMICK-DEERING INDUSTRIAL TRACTORS have long been identified with the construction industry—they are pioneers in the development of the roads of the nation. They had to be good, they had to have the stuff, to be able to stay in this business. They are the choice of road builders and contractors because they have proved their performance, their efficiency, their economy. They are backed up in their work by unusual after-sale service. The McCormick-Deering Industrial Power line includes four sizes of wheel tractors; two sizes of crawler tractors, one of which is available with gasoline or Diesel engine; and three power units, including one with a Diesel engine.

Get in touch with the nearest International Harvester branch, or with any McCormick-Deering distributor or dealer, for prices, specifications, and other detailed information.

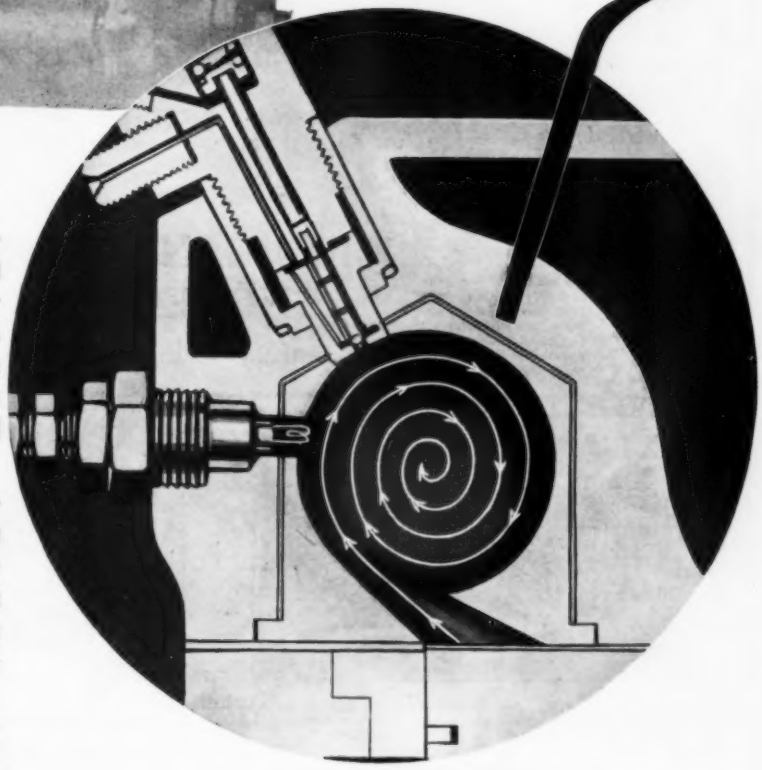
INTERNATIONAL HARVESTER COMPANY
606 So. Michigan Ave. *of* America *(Incorporated)* Chicago, Illinois

Above: Three McCormick-Deering-powered maintainers keep this road in good condition.

A McCormick-Deering-powered shovel handling dirt on a sewer project in Chicago.

McCORMICK-DEERING INDUSTRIAL POWER

What IS the Comet Diesel



There is only one Comet Diesel. Invented and patented by Ricardo, it is built under license in America by the Waukesha Motor Company. It is called the Comet because the large spherical portion of the combustion chamber resembles a comet's head and the tangential outlet, the tail.

The combustion chamber is a separate insert surrounded by an insulating space and, being isolated from the cylinder and piston, it remains hot between each intake stroke, retaining the heat absorbed during the previous combustion, and adding it to the succeeding heat of compression. The large section of metal surrounding the throat prevents heat loss during transfer from combustion chamber to cylinder and piston on the working stroke. On the compression stroke this action is reversed, and this heated section also adds to the heat of compression.

More than 80% of the air is compressed into the chamber where the high temperature it reaches prevents delayed ignition and resulting roughness of operation. The fuel injected into the rapidly swirling air of the Comet chamber burns promptly, progressively, and smokelessly at all loads and speeds.

The Comet combustion chamber also insures smoother running under a wider range of fuel specifications than conventional Diesels.

Write for Bulletin 913. *Waukesha Motor Company, Waukesha, Wis.*

THIS IS No. 1 OF A SERIES

on the Comet Diesel. No. 2 will appear next month. A reprint of the complete series will be mailed on request.

WAUKESHA ENGINES

During December we hope you will remember to mention CONTRACTORS AND ENGINEERS MONTHLY.

The Truck Shovel with Many "Plus" Values

Light and compact — remarkable power in proportion to its size and cost

Smooth, full-circle loading; three-quarter digging; no tail swing

Travels under its own power

"Finger-tip" manipulation

Economical for the in-between jobs—the jobs that are too large for hand-shovel, yet too small to be economically handled by your big shovel

MICHIGAN POWER SHOVEL CO.

Benton Harbor, Michigan

A wide variety of uses—by merely adding a crane boom, a clamshell bucket, a dragline bucket, or a backfiller blade

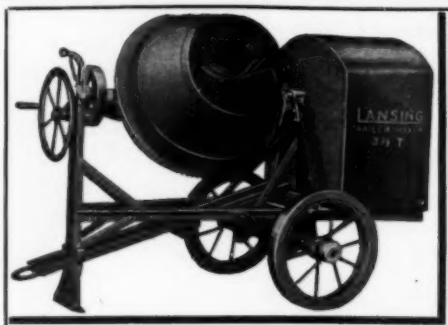
Write for Circular

"FLEX-PLANE CONTRACTION JOINTS"

Correctly spaced and installed control cracking, prolong the life and improve the appearance of concrete roads. Flexible contraction joints are rapidly and economically installed mechanically by the FLEX-PLANE machines.

Installers leased by

FLEXIBLE ROAD JOINT MACHINE COMPANY, WARREN, OHIO



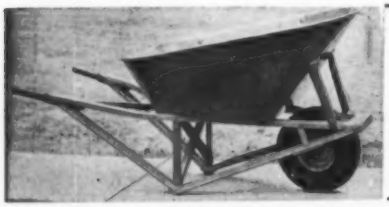
LANSING 3½-T fast Trailing fast Mixing

Specifications and Prices that will amaze you

Write – Phone

LANSING-COMPANY, LANSING, MICHIGAN

CHICAGO BOSTON NEW YORK KANSAS CITY MINNEAPOLIS SAN FRANCISCO



WHY do Hyb-Lum Wheelbarrows REDUCE HAULING COSTS?

for the simple reason that

being made of aluminum alloy, less than half the weight of steel, they permit a bigger pay load—15% bigger.

Sheet Aluminum Corporation, Jackson, Mich.

IF You have recently MOVED, let *us* know by using this coupon so you will continue to receive CONTRACTORS AND ENGINEERS MONTHLY promptly.

Contractors and Engineers Monthly
470 Fourth Avenue, New York

Gentlemen: Kindly change my address on your subscription list *from*

Name .....

Old Address .....

— TO —

Name .....

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City and State .....

THE value of the Austin *77* Motor Grader is told by its year-round versatility. No better idea of its money-saving qualities can be presented than the picture of the same machine turning from miles of snow removal to entirely different jobs like grading, ditching and scarifying—or oil mix on a hot summer day.

These functions of the Austin *77* are different at first glance—but fundamentally the same rugged construction, the same easy blade control, and the same positive traction (dual or single drive) are the secret of effective work. The principles are the same. For this reason the Austin *77* has won the preference of contractors, engineers and highway officials as the most all-round useful machine on the road. Whether equipment is bought with public or private money, no more consistent return can be expected than from this year-round machine. Send the coupon for new descriptive booklet.

The Austin-Western Road Machinery Company • Home Office: Aurora, Ill.

Cable Address: AWCO, Aurora.
Branches in Principal Cities.

■ grade
■ ditch
■ oil mix
■ maintain
■ scarify

When snow removal depends on attachments to tractors and trucks, learn about the Patented Toggle Safety Release of Western Snow Plows.

The Austin-Western Road Machinery Co.
Y Aurora, Illinois
Please send details on Austin 77 Motor Grader.
☐ Also on Western Plows.
Name.....
Address.....
City..... State.....

ROAD GRADERS • MOTOR GRADERS • ELEVATING GRADERS • DRAGS

ROAD ROLLERS

Austin-Western

DUMP WAGONS

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BITUMINOUS DISTRIBUTORS • ROAD-MIX MACHINES • CULVERTS
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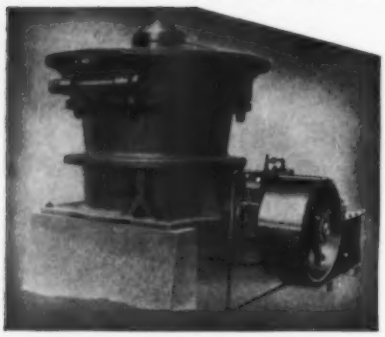
HIGHER SPEED WITH GREATER CAPACITY



The short, compact structure, steel frame and steel crown of the Telsmith Gyratory Crusher give it super-stamina to withstand greater loads. Cut steel drive gears and force feed oiling permit higher eccentric speeds and faster gyration. Its greater receiving and crushing area allows faster feeding. Telsmith's *parallel pinch* stops slippage, crushes full tilt all the way down—*guarantees bigger capacity*. *Write for Bulletin C-34.*

SMITH ENGINEERING WORKS, 4014 N. HOLTON ST., MILWAUKEE, WIS.

TELSMITH

50 Church Street . . . . . New York City
211 W. Wacker Drive . . . . . Chicago, Ill.
Agents in all principal cities.

WRITE FOR NEW BULLETIN

AS the majority of three-wheel rollers are now called upon to scarify as well as to roll, Buffalo-Springfield machines, when so ordered, can be equipped with a pressure scarifier of highly refined design, attached to the rear end of the roller frame. This scarifier may be powered by compressed air or by a hydraulic system according to the purchaser's wishes.

Each tooth of a Buffalo-Springfield pressure scarifier is held by a separate tooth arm, permitting the flow of the loosened material between the teeth. When the scarifier is not in use, it is suspended by a hook without need of pressure in the scarifier cylinder.

TRADE MARK

FISKE'S

LUBRICANTS

for all

INDUSTRIAL and AUTOMOTIVE PURPOSES

Cup Greases
Tractor Lubricants
Pressure Lubricants
Gear Greases & Shields
Cable Dressings

Roller Bearing Greases
Transmission Lubricants
Universal Joint Grease
Fibre Greases, Etc.,

Standard of Quality and Uniformity GUARANTEED by 64 years' experience

MANUFACTURED BY

FISKE BROTHERS REFINING CO.
(ESTABLISHED 1870)
PLANTS AT
NEW YORK, N. Y. — TOLEDO, OHIO

KOEHRING

Maintains Progress

KOEHRING Company has maintained its March of Progress during 1934. In addition to improvements and developments in Pavers, Dumptors, Mud-Jacks, Shovels, Cranes and Draglines —

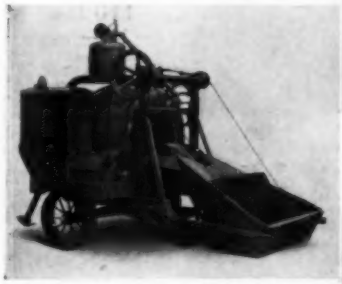
A complete line of concrete mixers — newly designed for modern requirements — Sizes 7-S to the 84-S.

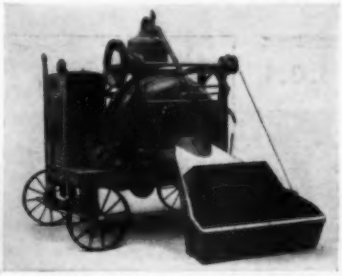
The Koehring Dandie Mixers, 7-S, 10-S, 14-S — 4 wheel and trailer type — are exceptionally light in weight — full spring mounted — short in overall length and width.

The Heavy Duty Construction Mixers — full anti-friction bearing — compact design — short frame with power mounting underneath charging chute — equipped with the distinctly new Koehring Flow-Line Discharge.

KOEHRING DANDIE MIXER

7-S — 2,870 pounds
10-S — 3,800 pounds
14-S — 4,950 pounds
Automatic Skip-Flow Shaker



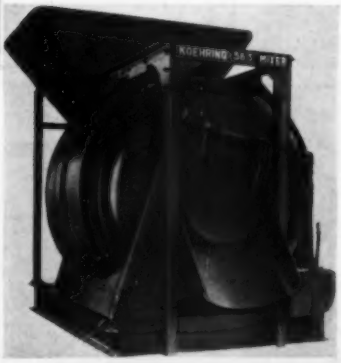


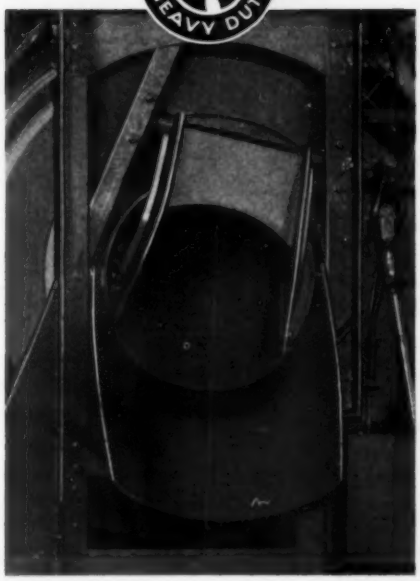
KOEHRING DANDIE TRAIL-MIX

7-S — 2,950 pounds
10-S — 4,000 pounds
Automatic Skip-Flow Shaker

KOEHRING HEAVY DUTY CONSTRUCTION MIXERS

Sizes 28-S, 56-S and 84-S with the Koehring Re-Mixing Action—simplified, high speed, power discharge — Multiple V-Belt drive —automatic water tank and batchmeter optional equipment.





The Koehring Flow-Line discharge — a revolutionary departure from the conventional arrangement — greatly decreases discharge time — causes a minimum of segregation — substantially reduces abrasive wear. It allows a wider expanse of chute, lessens the height of drop to a minimum and permits an unbroken, natural flow of concrete from the bucket to the distributing system . . . The tilted and widened discharge chute reaches far and high into the drum, immediately below and across the full width of buckets — to receive practically the full load of each bucket in one drum revolution.

KOEHRING COMPANY

MILWAUKEE *Division of National Equipment Corporation* WISCONSIN

LE TOURNEAU

6200 FEET ROUND TRIP HAUL
Four Heaped Loads Per Hour

Clifton & Applegate are making this haul and time, on their Priest River Contract with two Le Tourneau 12-Yard Carryalls. Long hauls such as this often are necessary. This calls for DEPENDABLE EQUIPMENT—CAPACITY LOADS—SPEED. Le Tourneaus are built to produce—even under these conditions.

Le Tourneaus are the answer to your dirt moving problems.

R. G. LE TOURNEAU, INC.
STOCKTON, CALIF.

Write for literature and Engineering data on this equipment.

Long Range Digging at LOWEST Cost

When you have an excavating job that calls for the dirt to be moved several hundred feet or more, it will pay to lay your problem before Sauerman engineers and see if the work can be accomplished better and cheaper with a Crescent Scraper.

These scraper machines are made in sizes small enough for local gravel plants and large enough to build Mississippi River levees. Write for catalog.

SAUERMAN BROS., INC., 464 S. Clinton Street, CHICAGO

"The Strongest Geared Power for Its Weight in the World"

REG. U. S. PAT. OFF.

CAPACITY 5 TONS STRAIGHT LINE

POSITIVE INTERNAL BRAKE

Weight 110 lbs.

Size 16x17x13-in. high

Two Speeds 4 to 1 24 to 1

Mfg. and Distributed in Canada by
London Concrete Machy. Co., Ltd.,
London, Ont., Canada

Price in U. S., $75 F. O. B. Warehouse Points: Chicago, Brooklyn, New Orleans, Houston, and from Dealers in Principal Cities. Descriptive Literature and List of Dealers gladly mailed.

BEEBE BROS.
2724 Sixth Ave., So. Seattle, Wash.

HVASS

HVASS

BITUMINOUS DISTRIBUTORS
HEAVY-DUTY TRAILERS
SAND SPREADERS
CHIP SPREADERS
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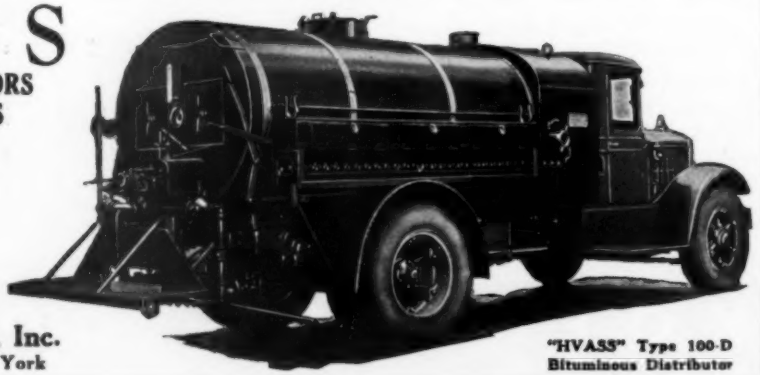
SPRINKLERS
HEATING KETTLES

Manufactured by

CHAS. HVASS & CO. Inc.
508 East 19th St. New York



"HVASS" Type 100-D Bituminous Distributor

The New Chrysler
AIR COMPRESSOR

SAVES
in First Cost . . .
SAVES
in Operating Cost

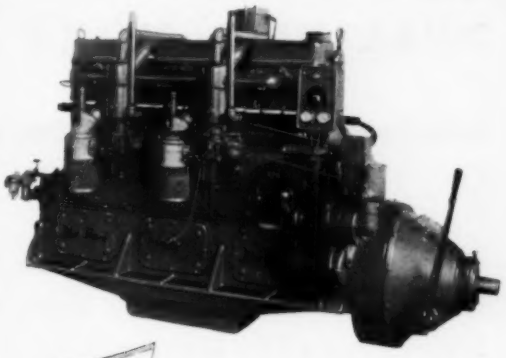
During the recent season a Chrysler 136-foot air compressor replaced a standard 220-foot machine that had been used for mud-jack work in raising sunken roads.

This compressor was called upon to operate a rock drill to drill the necessary holes, a concrete breaker for relieving binding at the joints, and for the actual pumping of mud in order to raise the low spots.

The Chrysler compressor handled all this work just as effectively as the larger compressor and operated on 10 gallons of gas per day, one-third of the amount required by the larger and much costlier compressor.

This is but one example of many instances in which the new Chrysler air compressor proved its worth. Write for further details and specifications.

CHRYSLER
MOTORS
AMPLEX DIVISION
DETROIT, MICHIGAN



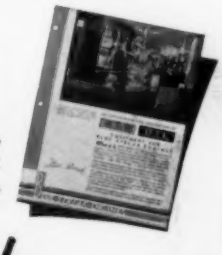
YOU NEED NOT
SPLIT HAIRS

to Prove Blue Streak
Oil-Burning Performance

Users say things so good about Blue Streak combustion that they don't look right in print, but it can be said that you need not split hairs to prove the superior Blue Streak performance. This traces to the fact that the oil-burning Blue Streaks are no experiment. Years of development, ample research facilities, and the widest industrial engine experience are back of them. Climax engineers the Blue Streak to meet any speed and load condition. Blue Streaks do the work with revealing ease, snap, and economy. Blue Streak engineering and *Blue Streak Combustion* are the reasons.

DON'T FAIL
to Get This Folder

Briefly, it describes Blue Streak Oil-burning Combustion—*something you ought to know,* whether you are buying engines now or a year from now. Get this folder—it has started many a user toward long-term Blue Streak friendship. CLIMAX ENGINEERING COMPANY, 111 West Monroe St., Chicago, Ill.



The "low-down" on oil-burning. Save! Get better results! Folder tells all. →

Blue Streak
Gas, Gasoline and Oil-burning Engines

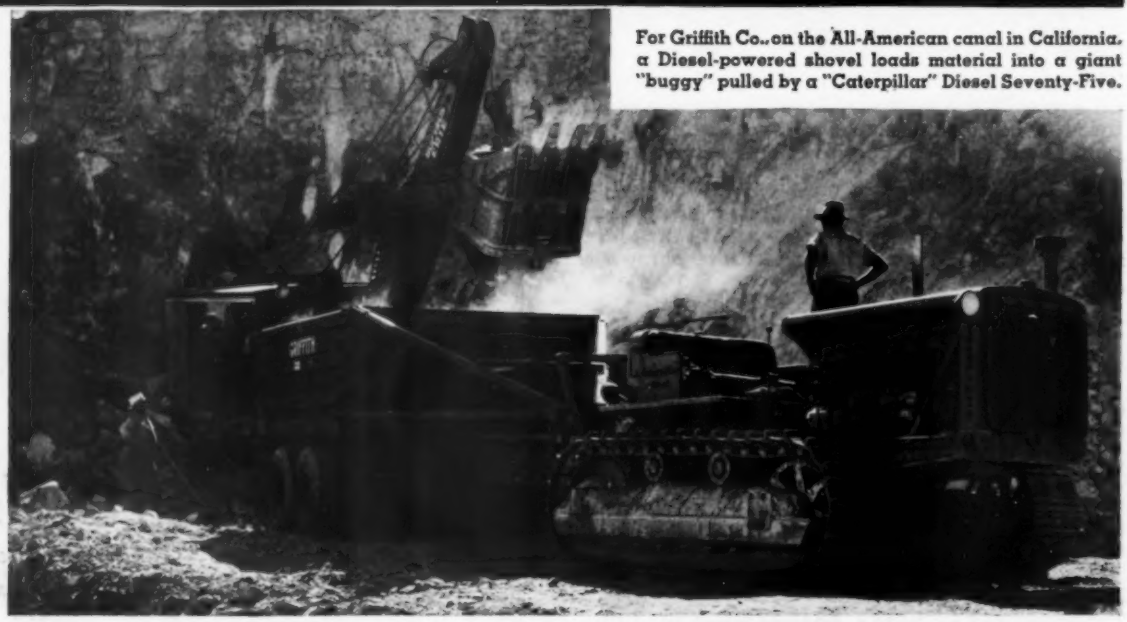
"THE 'CATERPILLAR' DIESEL HAS CUT OUR FUEL BILL MORE THAN 80%"

—SAY LUEBKEMAN BROTHERS, OF BUENA PARK, CALIFORNIA, WHOSE FUEL COST FOR THE DIESEL IS LESS THAN ONE-FIFTH THAT OF AN EQUAL-POWERED GASOLINE TRACTOR.

OWNERS are enthusiastic over their Diesel economies in power costs—enthusiastic, too, about other "Caterpillar" features. Luebkeman Brothers write: "The 'Caterpillar' Diesel burns all the fuel, runs evenly when it idles, accelerates fast, lugs better than anything we have ever seen." Ask for the full story of "Caterpillar" Diesel Tractors and Power Units. Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

A. J. Schrader, of Scranton, Pa., uses "Caterpillar" Diesel power to remove the overburden for coal stripping operations.

AMERICA GOES DIESEL · AMERICA GOES DIESEL



For Griffith Co., on the All-American canal in California, a Diesel-powered shovel loads material into a giant "buggy" pulled by a "Caterpillar" Diesel Seventy-Five.

Hollow Piers and Spandrel Columns

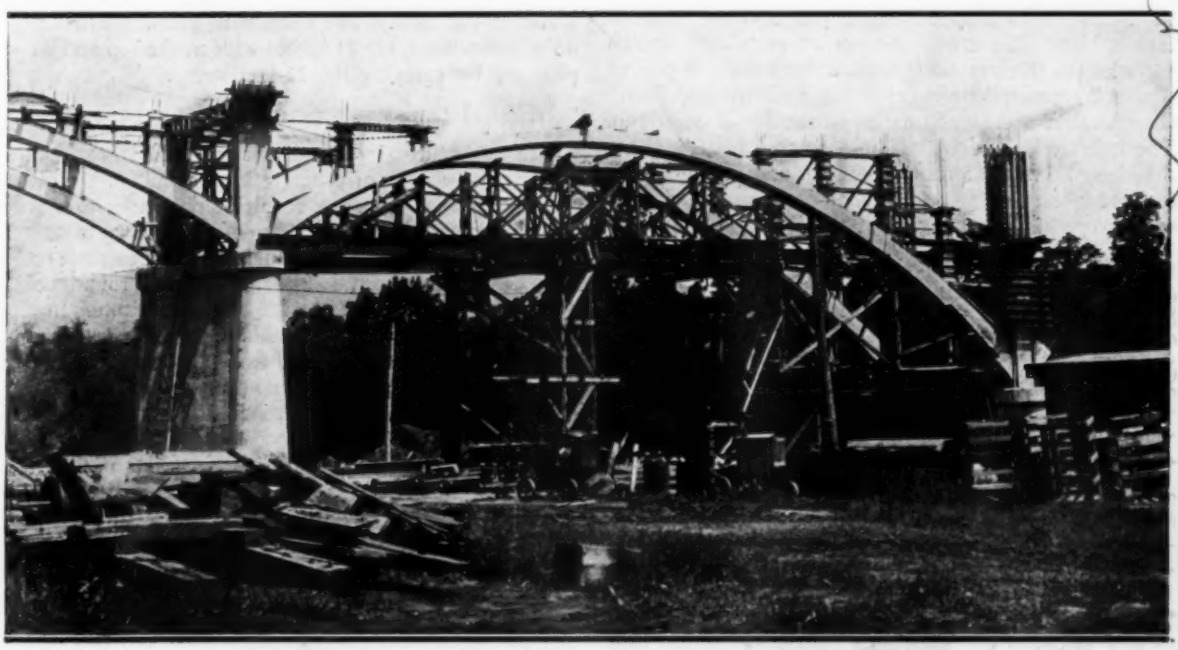
Features of New Concrete Bridge

at Ripplemead, Va.

Methods Used by Sammons-Robertson Co., Inc., in Erecting 1,328-Foot Structure

THE construction of one of the most attractive concrete bridges in the east, with arch rings, hollow piers and spandrel columns across the New River and over the Norfolk & Western and the Virginian Railways at Ripplemead, Va., near the West Virginia line, provided an interesting series of problems for the contractor, Sammons-Robertson, Inc., of Huntington, W. Va. Work was started on this project, NRH 128 ARB1, April 5, 1934, with the excavation of the river bank pier foundations, concreting was started April 30 and the pouring of the arch ribs on July 13. The contract required the completion of the work by November 21, but automatic increases of time due to extras will probably extend the time to January, 1935. The project includes 0.7 mile of approaches of one-course macadam with 20-foot surface treatment.

The reinforced concrete arch rib structure has four 144-foot 8-inch river spans, two 122-foot 4-inch unsymmetrical spans, one on either side of the river spans, three 100-foot spans on the west end and one 100-foot span on the east end with a 22-foot concrete beam span at either end of the structure, all units of the superstructure being skewed at an angle of 32 degrees with the substructure. The river section of the bridge is 80.6 feet at finished grade above the river. All the piers were designed to take the thrust of the arch ribs on one side only during construction, and Piers K and S in addition were designed as abutment piers to take all of the thrust of the arch ribs and superstructure on one side against the arch ribs alone on the opposite side. This arrangement was made to speed up construction operations and to insure safety during this period.



Typical Timber Cribbing and I-Beam Centering on One of the Hand Spans

A Typical River Bank Pier

Pier G, which may be taken as a typical river bank pier, was built in the dry but required 16 feet of excavation below the design depth because the borings struck unusually large limestone boulders which were mistaken for limestone ledge as that is the native rock. On another pier it was necessary to excavate 18 feet below the design depth and on the remainder, with two exceptions, the extra depth varied from 2 to 12 feet.

The footing for Pier G measures 36 x 17 feet with the corners cut to save concrete. As the rock was uneven the foundation was stepped and poured with Class B 1:3.50:5.50 concrete to fill. The footing was poured 6 feet high in two 3-foot steps. Above this is the solid pier carried to the original elevation of the bottom of the pier. The remainder of the pier is hollow in accordance with the design. The hollow portion is 38 feet 3 inches high, and the other piers vary in height from 34 feet 3 inches to 46 feet 3 inches. The walls of the hollow piers are 18 inches thick but the piers are solid under the skew arch ribs. The pier columns are 4 x 5 feet at the base with two pilasters which are 28 inches wide and 1 foot thick at the base and have the same batter as the spandrel columns. These pier columns are hollow with a 9-inch heavily reinforced wall; in Pier G they measure 13 feet 5 inches high to the bearing plate which carries the concrete spandrel arches. The columns, which are in pairs at each pier, are tied at the top by a concrete beam 21 inches wide and 30 inches high. The columns are 18 feet apart measured at right angles center to center. The spandrel concrete arch ribs are also spaced 18 feet on centers and resting on the tops of the columns.

The roadway slab is 8 inches thick at the center, 7¼ inches thick at the curb and 24 feet wide between curbs. The curbs are 10 inches high and carry the hand-rail posts set back 6 inches from the face of the curb with the hand-rail cast in place. The hand-rail posts are placed only over each pier and are 3 feet 9 inches high. The crown section of each arch, which includes the three middle panels of each span, is poured with solid spandrel walls below the deck instead of with the spandrel arches as on the remainder of the span. The hand-rail openings, which form the balusters, are 5 inches wide with 5 inches between and measure 14½ inches high, including the top semi-circular section. The curb was poured monolithic with the slab and the floor beams, and the hand-rail was poured later.

The Construction of a River Pier

River Pier M is typical of the five piers in the bed of the New River, and is selected for description. The river bed consisted of 2 feet of gravel underlaid with 4 feet of muddy gravel on top of the rock which was very uneven. It was very difficult to get a shovel across the stream in spite of the shallow depth of water, about 2 feet at normal flow and 4 feet at flood stage, even with the use of mats, which was slow and expensive. Two Lorain 75B cranes were used on the foundation excavation and one Industrial-Brownhoist crane.

The footing for Pier M was widened from 41 x 18 feet to 44 x 32 feet because the rock was not suitable; in fact, the rock was solid over only about 50 per cent of the area, necessitating the enlargement for extra bearing. The footing was stepped in and poured 6 feet thick with a single 2-foot step. The cofferdam was built outside the river and placed in sections. It was built up 5 feet thick and 5 feet high with overall dimensions of 60 x 40 feet. The outer shell was built of 1-inch rough sheeting, 2 x 4-inch studs on 3-foot centers, and with two sets of wales of 2 x 6's wired all around. The whole coffer was filled with clay. On the inside the sheeting was 44 feet long by 32 feet wide and the concrete was poured against the sheeting which was held with rings of 8 x 10's and cross-braced with the same size timber laced at the corners with 2 x 10-inch planks. The sheeting was driven to 2 feet below the footing elevation with an Ingersoll-Rand sheeting hammer and the material excavated with a Lorain 75A with a 50-foot boom and a 1-yard clamshell. The excavated material was wasted around the outside of the cofferdam banking against the wash of the rapid flow of the stream. The material excavated was chiefly clay, gravel and limestone boulders. The latter had to be shot after drilling with jack hammers.

For unwatering the cofferdams and keeping them in a dry condition during the preparation of the footing for pouring, two Jaeger 6-inch and one Novo 6-inch pumps were used. There were also two 3-inch, one 2-inch and a 4-inch pump on the job for occasional use.

The river piers were 39 feet high carrying columns 40 feet high, hollow as with the other piers, and with 9-inch walls. The river piers were flared at the base to 14 feet wide to form both an upstream and downstream nose and to avoid high tensile stresses in the footing cantilevers.

The Abutments

The two abutments both have 2½-foot footings and measure 19 feet 5 inches above the footing, which is 9 feet 6 inches wide and 2½ feet high, stepped in 6 inches at the back and 12 inches in the front. The abutment wall faces are vertical with the back, battered 4 inches per foot. The abutment walls, which carry no reinforcement, are 21 inches wide at the top and have pilasters for carrying the 22-foot spans.

Heavy Reinforcing Throughout

The structure is heavily reinforced throughout, making the placing of concrete in the walls of the piers and columns an operation requiring particular care and patience. The footings are reinforced with mats of steel bars. All the piers have pairs of 1-inch square rods on 12-inch centers and horizontal 1-inch round bars, two in each plane on an average of 21-inch centers in the hollow sections. The girders are reinforced top and bottom and have stirrups and the floor beams the same. The bottom rods in the girder beams are in two planes, spaced 2½ and 5½ inches from the bottom. The top rods are in one plane in the center of the girder and floor beams. The slab reinforcing consists of one set of rods ½-inch square, set 1½ inches from the bottom of the slab. The spandrel arches carry three 1-inch round bars along the bottom of the arch with stirrups on the radial lines. The bulk of the deck reinforcing is in two planes 1½ inches from the bottom and the second the same distance from the top. These are ⅞-inch round rods for the longitudinal and transverse reinforcing and ½-inch square rods for the stirrups.

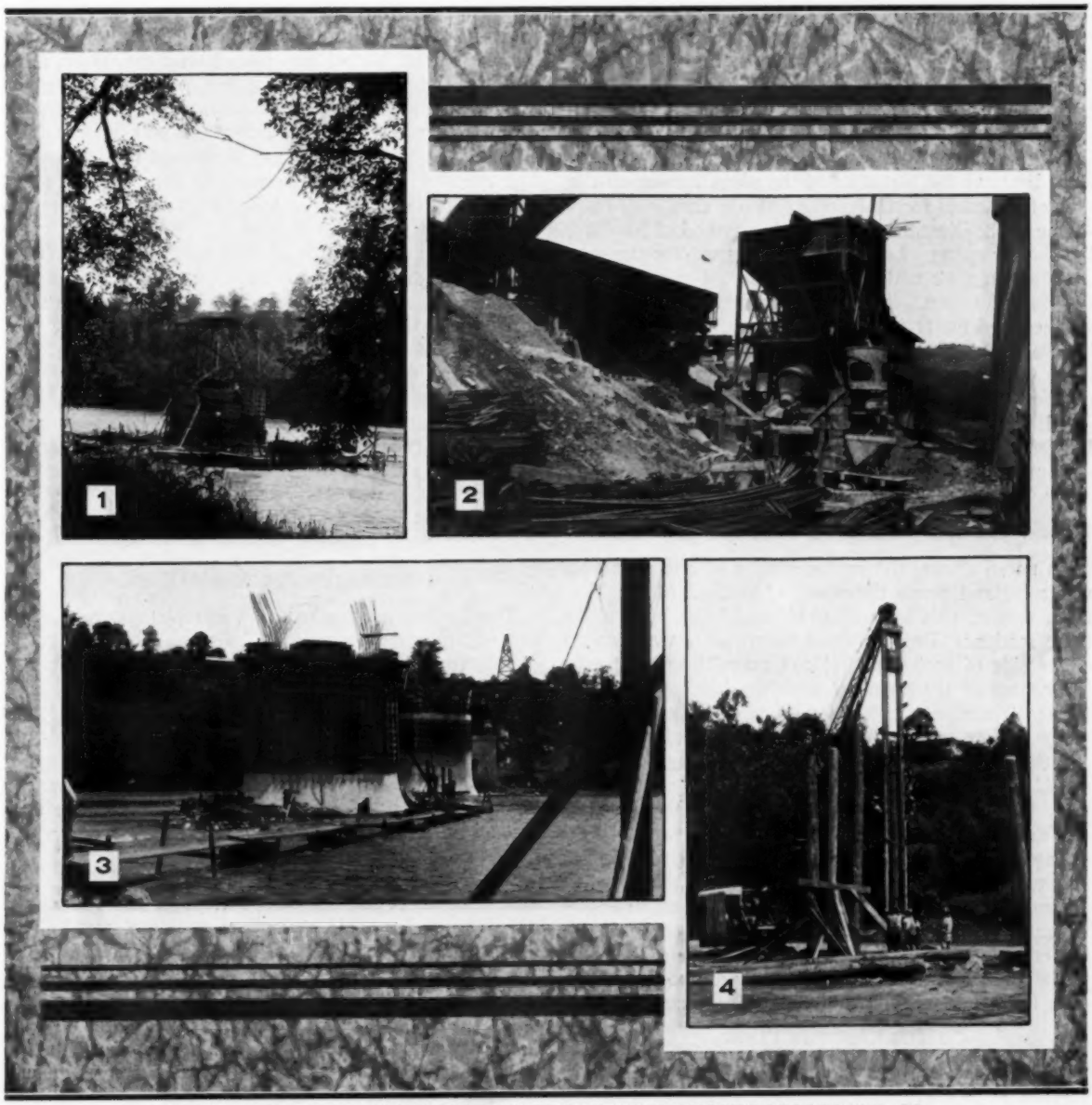
The hand-rail carries two bars top and bottom, all ½-inch square and one similar vertical bar midway between each of the baluster openings.

THE CONCRETE ARCH RIBS

The concrete arch ribs which give such a distinctive appearance to the structure are all 4½ feet wide and vary from 22 inches thick at the top for the smallest arch to 2 feet 4 inches for the largest. At the haunch the thickness varies from 3 feet to 3 feet 9 inches. The reinforcing is carried top and bottom, 3 inches from the outside in both cases, with 6 bars ranging from 1¼-inch to 1-inch and all square. Lace bars of ½-inch square steel run on 18-inch centers the entire length of the ribs. The longitudinal bars are all lapped a minimum of 4 feet 6 inches.

THE HIGH LINE

A cableway with a span of 1,513 feet was used to carry all materials across the river to the east side. The head tower 93 feet high as well as the 87-foot tail tower were both A frames anchored to deadmen in the hills back of the two towers. The carrier cable was a 2½-inch Lockcoil Leschen cable. The endless cable was ¾-inch American Steel & Wire Co. cable while the load line, the same size, was furnished by the same company. The button line was also ¾-inch. The power for operating the cableway, which had a capacity



FORM WORK AND CONCRETE PLANT ON THE SAMMONS-ROBERTSON CO. CONTRACT AT RIPPLEMEAD, VA.

1. Form work for one of the river piers. 2. The concrete plant, showing the aggregate trestle at the left and the 1½-yard roller-gate concrete bucket being lifted by the high-line at the right. 3. The completed river piers partially stripped. 4. Driving timber for centering in the stream.

of 15 tons, was furnished by a 2-drum Lidgerwood steam-driven hoist. The traveling speed for the trolley was 1,200 feet per minute; the hoisting speed 500 feet.

ECONOMICAL CENTERING USED

A type of centering that proved particularly economical was used by the contractor for this job. Soil tests of the river banks showed that the ground could support about 2 tons per square foot. On this basis, the footings for all centering was designed for 1 ton per square foot for safety. The footings were poured of a lean concrete, using cement from the bag shaker used on all bags emptied at the mixer. Round timber piling 25 feet long with 10-inch tips were driven to refusal to support the timber bents for the falsework for all river spans.

The use of 30-inch I-beams 50 feet long and weighing 200 pounds per foot eliminated the use of a series of mud sills or a large number of concrete footings. For the longer arches a single 50-foot I-beam was carried on two bents to support the crown section of the arch. Two other I-beams were carried lower on the same bents at the elevation of the piers, resting on the tops of the piers for the support of one end.

One of the illustrations shows the method of handling the shorter spans. Local timber was used for the supports and 6 x 6's with double 8 x 8's for caps and 3 x 12's for centering. The bents for carrying the forms were carried on 11-foot 2-inch centers. All form lumber was 1⅛-inch x 8-inch stock surfaced four sides and lined with ⅛-inch Masonite for eliminating the large number of form-lumber marks.

All reinforcing was tied with Bates tie wires and Universal form clamps with 2-inch cone nuts were used on all the piers. For the spandrel columns Richmond Old Reliable column clamps were used.

FORM WORK FOR DECK IN CENTER SPANDREL SECTION

As noted above, the center section of the spandrels was solid and hence the standard method of handling the forms of this type of work could not be used in these sections. Regularly 6 x 6-inch posts were set on either side of each spandrel column with one extra in the center of the spandrel arch for holding the deck forms. These posts supported transverse 8 x 10's measuring 26 feet long which carried the deck forms. On the three center or crown panels which are solid the outside curb could not be supported through the arch ring. The curb had a 26-inch overhang. To overcome this an 8 x 10 was swung under the arch ring and held up against it by two ¾-inch bolts with straps across and carried up to an 8 x 10 over the arch to form a clamp. Then another 8 x 10 was placed longitudinally to carry the 6-ton load of the concrete arches. Beam bottoms and curb forms were assembled in the yard below and lifted to the deck by the high line but all the deck forms were assembled on top by the carpenters.

THE CONCRETE PLANT

The concrete mixing plant for the entire job was located near the west end of the structure with the mixer set so that it discharged on the center line of the bridge. A spur track was extended onto a trestle from which the sand and stone for the concrete was dumped for storage. All batching was done by a Blaw-Knox Inundator which delivered the aggregates to the Smith ¾-yard tilting mixer driven by a Waukesha motor. North American regular and high-early-strength cement were used, the latter for the arch ribs so that the forms could be stripped in seven days. All Class A concrete was designed for a 1:2.3:3.7 dry-rodded mix by volume, using a water-cement ratio of 0.85 and a cement factor of 1.4.

A section of deck forms was omitted from the span immediately above the mixing plant so that the high line could pick up the 1½-yard Blaw-Knox roller-gate bucket and the 1-yard Insley bottom-dump bucket which had been built up to carry 1½ yards of concrete. A short section of industrial railway track was set on a slight grade from in front of the mixer to a point near the pier to the east of the mixing plant and two industrial cars ran back and forth on the track, each carrying a bucket. One bucket was placed on a car, filled, and then the Lidgerwood gas hoist that pulled the cars up grade was slacked off and the cars rolled down grade to the spot where the high line could pick up the full bucket after placing the empty bucket on the other car. The concrete plant was operated by four men, one on cement, one batchman, one mixer man and a hoist man.

This outfit poured as high as 108 yards of deck concrete a day and 75 yards of arch concrete a day. For pouring the columns and arch rings a chute was made up that attached to the buckets by two chains. It was so balanced that it handled readily. For pouring the deck the concrete was dumped direct from the buckets and for the piers an 8-inch elephant trunk chute was used, equipped with metal baffles to eliminate segregation. All concrete was well puddled to prevent honeycomb which was somewhat difficult in the hollow pier and column sections which were so heavily reinforced. Jackson 6-inch diameter Vibro-spades were used wherever the dimensions of the structure permitted, for insuring a dense concrete.

LABOR ORGANIZATION AND HOURS

The contractor worked two complete crews, each three 10-hour days a week. Work was shut down completely during the noon hour unless a pour was in progress that could not be stopped without injury to the strength of the structure. During the noon hour the high line was frequently used to handle materials to place in order to save time.

The average labor organization consisted of twenty foremen per day, eighty-five skilled laborers and sixty-five unskilled laborers.

PERSONNEL

The contract for the construction of the reinforced concrete bridge and approaches at Ripplemead, Va., was awarded to Sammons-Robertson Co., Inc., of Huntington, W. Va. The work was under the immediate charge of D. T. Hogue as Superintendent for the contracting company. The work was done for the Virginia Department of Highways, C. S. Mullen, Chief Engineer; William R. Glidden, Bridge Engineer and G. T. Lemmon, Construction Engineer. For the Salem District, in which this work was located, S. C. Liggett is District Engineer, with John L. Sneed, Resident Engineer and T. Chandler Martin, Resident Inspector on this project.

Producing Aggregate *for* Fast Paving

B. Perini & Sons, Inc., Operated Complete Sand and Gravel Plant for Concrete Paving Contracts on Cambridge-Concord Highway

WHEN the noon half-hour lunch period came in the middle of the 12-hour, 2-shift day on the Perini contracts for paving sections of the new Cambridge-Concord highway in Massachusetts, the huge 5-yard truck-mixers flocked to a spur road and were washed out just like a part of the much-publicized herd of pachyderms from the World's Greatest Show. They then backed around and headed for the mechanic's shed where the oil and gas were checked and the greasing done by the drivers going off duty. Well-trained monsters, those machines, for they faithfully performed the task of producing better concrete for the highway.

Preparing the Aggregate

A large roadside pit located at about the middle of Sections 3, 4, and 5 of the five sections on the Cambridge-Concord highway described in these pages last month (Contractors and Engineers Monthly, November, 1934) was opened and furnished all the aggregate for the concrete for both structures and pavement. This location gave a maximum haul of 6 miles for the concrete. Throughout the work the concrete was mixed longer than the minimum required by the specifications, 5 minutes.

The sand and gravel pit was excavated by a Lorain 55 and a 75B working together, or alternating as one or the other was needed for other work on the grade. They loaded to a fleet of from two to eight Ford trucks with Wood hydraulic dump bodies. These trucks hauled the pit-run material distances varying from 200 feet to as much as ½ mile to the receiving hopper over the crusher. A grizzly of steel bars spaced about 12 inches apart kept out the largest cobbles, but all smaller material went into the hopper to the Good Roads chain feeder and thence to the scalping screen. The Niagara 3 x 6-foot scalping screen took out all sand and gravel under 2¼ inches and let it drop into a feeder hopper delivering to the boot of the belt conveyor to the washer. Oversize material went to the 16 x 32-inch Acme jaw crusher and thence to the belt through a feeder hopper. The crusher was run by belt drive from a 125-hp gas engine, and a pulley on the far side of the crusher shaft drove the feeder and scalper screen.

A 190-foot Barber-Greene conveyor with a 24-inch belt carried the aggregate to the top of a 60-foot tower where the screens and washing plant were located. A 50-hp Sterling gas engine on the tower drove the head pulley of the belt conveyor, the vibrating screens and the screw washer for the sand. The wash water for the plant was supplied by an 8-inch LaBour centrifugal pump located about 300 feet away on the edge of a small artificial pond made by damming a brook.

At the top of the conveyor the aggregate was delivered to an apron and divided into two practically equal parts, going to two vibrating screens. Over each screen were two sprays of water for washing the aggregate and at the end baffles of sheet iron and rubber were hung to prevent any over-energetic stone from bouncing free of the chutes and causing injury to passing workmen. The entire plant was well equipped with sturdy ladders or ramps or stairways with hand rails to prevent, insofar as possible, any accidents which could be avoided.

The left hand vibrating screen was a 3 x 8-foot Niagara with three decks, the top with 2¼-inch holes, the center with ⅝-inch and the bottom with 1¼-inch holes. The right hand screen, also a Niagara vibrating unit, had only two decks, the top a 2¼-inch and the bottom a ¼-inch. Two chutes at the side of the plant carried the two sizes of stone to stockpiles. The sand

was delivered to a pair of New England screw washers 20 inches in diameter and 10 feet long set at more than the usual angle so as to take out as much water as possible. The water drained through a long sheet-metal pipe to a lagoon, while the sand went through a chute to a separate stockpile.

PREPARING THE DRY BATCHES

At a suitable distance from the stockpiles, so that the Lorain 77 Caterpillar-diesel crane with its 65-foot boom could handle the aggregates readily, the contractor set up his Butler batching plant and bins. The material was loaded with a 1½-yard Mead-Morrison clamshell bucket to the three compartments of the bin. One man for each shift operated the batchers and controlled the water for the large batches for the Jaeger 5-yard truck mixers. The average batch consisted of 11,460 pounds of mixed stone, 5,760 pounds of sand, 110 gallons of water and at the next stop the 33 bags or 3,102 pounds of bulk cement was loaded.

Working from a platform beneath the batching plant one man opened the tops of the mixer drums with a ratchet wrench, and also opened the water holes to the tank on the truck. When the batch was delivered, the water pipe was so arranged that it swept around the delivery hopper and washed out all the sand that might possibly have stuck in the hopper which did not have a steep pitch due to the contour of the ground.

BATCHING THE BULK CEMENT

The bulk cement was delivered in LCL containers on a siding at West Bedford, Mass., a distance of about 4½ miles from the plant. The containers were dumped by gravity into the hauling trucks of which there were three with a capacity of about 150 barrels each. The

(Continued on page 40)

AGGREGATE FROM GRAVEL PIT TO TRUCK-MIXER

1. A power shovel loading one of the shuttle trucks in the pit. 2. Dumping the pit-run gravel into the receiving hopper over the crusher. 3. The 190-foot conveyor carrying sand and crushed gravel to the screens and washing plant. 4. Loading the batcher bins with the screened washed aggregate. 5. Bulk cement came in on the high road, was batched and went out on the low road in the truck-mixers.

The Lubrication *of* Wire Rope and Chains

The Twelfth of a Series of Articles on an Important Phase of the Maintenance of Construction Equipment

LUBRICATION of wire rope is distinctive, as compared with lubrication of any other type of machinery or mechanism, in that it must function both internally and externally. In other words, the inner strands of the rope must not only be prevented from coming into actual frictional contact with one another, but also there must be means to prevent entry of water or dirt which would cause corrosion and abrasion. When wire rope leaves the manufacturers' plant the hemp core is thoroughly saturated with a lubricant and the rope is lubricated throughout for immediate service, as well as for protection from corrosion until put into use. There is a divergence of opinion among wire rope engineers as to the correct type of lubricant to be used for the lubrication of rope in service, but they are agreed that the lubricant should have sufficient penetrating properties to permit its passing readily between and over each individual strand of wire to the hemp core, which absorbs the lubricant and acts as a reservoir, from which it is pressed out again as the rope is flexed in passing over sheaves or hoisting drums under load.

Three Schools of Thought

One group of engineers maintains that any lubricant or oil sufficiently light and penetrating to work through to the core with rapidity should be satisfactory for wire rope lubrication. There are many types of light oils which would accomplish this but which have very poor lubricating properties and would prove to be dire failures as a lubricant for the exterior of the cable. Furthermore, many of the light oils would be forced from the core, when the rope is under load, and carried to the outer surface in such volume as to cause waste and prevent its penetrating again to the core before passing over sheaves or drums. Therefore, in using a lubricant of this character, it would be necessary to make frequent application to insure constant lubrication.

There are many other engineers who advocate the use of a lubricant which has to be heated before it may be applied to the rope. The natural inference is that such lubricants have a high cold test and are too heavy or viscous to penetrate between the strands of wire to the core before being thinned by exposure to high temperatures. Such a lubricant, when heated and applied to a chilled cable, assumes its normal consistency before reaching the core, thereby defeating its purpose. Other lubricants of this character are very hard before heating and have a tendency to harden rapidly when exposed to cooler temperatures, creating a hard coating over the exterior surface of the rope. These are generally known as "shields" and when they pass over sheaves or hoisting drums the lubricant is likely to crack or chip and fall from the rope, leaving the surface as well as the interior exposed to the attack of water and ultimate corrosion, resulting in rapid deterioration of the cable.

Probably the majority of wire rope experts are strong advocates of the use of semi-fluid lubricants, specially compounded as a wire-rope dressing, which have sufficient powers of penetration to pass between each strand of wire, thoroughly coating it with a strong film of lubricant, but permitting the greater mass to be absorbed by the hemp core, from which it again passes slowly between the strands to the surface when the rope is under load or pressure. This action continues until the lubricant is eventually worn out and is replenished with another application. Any excess quantity of this type of lubricant which adheres to the outer surface of the rope is picked up by the sheaves or hoisting drum as the rope passes over, remaining there until it is again picked up by the rope as it may require it. This type of lubricant assures constant and thorough lubrication until it is worn out. It is of a consistency which permits application in its normal state and is easily applied by hand with a brush or swab, or through the medium of a box lubricator when such is available for that purpose. The lubricant should be sufficiently adhesive to cling to the exterior of the rope, sheave or hoisting drum, though they may be operating at comparatively high speeds.

Why Wire Rope Must Be Lubricated

In nearly all cases the principles governing the lu-

brication of wire rope are the same as would apply to the lubrication of any machinery parts where the same conditions exist. It is essential that a wire rope lubricant must accomplish two of the general primary lubrication requirements. First, it must protect the rope against corrosion; second, it is essential that it maintain a constant film between the contacting surfaces to reduce wear. Wire rope as used on power shovels, boom draglines and cranes of excavating equipment is exposed to the weather, which tends to wash off or remove the protecting coating of lubricant, naturally permitting the rapid corrosion of exposed surfaces. The lubricant should be adapted to resist best displacement or removal by the elements and be impervious to the action of moisture or water.

There are two different conditions of rubbing action requiring lubrication: the movements of the wires relative to each other, inside of the rope, as the rope is bent or stretched; and the movement of the outer wires relative to the surface of the sheaves and drums contacted. If the sheaves are free and turn easily, there should be no appreciable slippage. There is always some creeping, especially on drums, and also sliding against flanges or the sides of the grooves. But the rope needs internal as well as external lubrication. The lubricant must penetrate and fill the interior spaces or interstices as well as cover the outside. The interior lubrication is not given sufficient consideration, as a rule, resulting in shortened service life from internal wear and, in the case of hemp center rope, from disintegration of the hemp. The hemp center acts as a pad or reservoir for the internal lubricant. These cores are thoroughly saturated with a lubricant during process of manufacture but, being of a comparatively light consistency, it is forced to the surface of the rope as the rope is stretched or bent under load, the core is compressed and it is necessary to renew the lubricant by a penetrating application. Otherwise the hemp becomes dry and absorbs an excess amount of moisture which causes internal corrosion of the metal and disintegration of the hemp.

Sometimes wire ropes break without giving evidence of undue wear on the surface. This is invariably caused by poor lubrication of the inner strands and core through failure of the lubricant to penetrate, thus permitting corrosion of the innermost strands.

It is perfectly obvious that adequate lubrication will prolong the life and increase the service rendered by wire rope, as it practically eliminates corrosion and reduces wear to a minimum, the two factors having the most destructive effect. To realize fully the value of protection from corrosion and wear, consider the structure of the rope. As a unit, wire rope is remarkably strong, very solid and substantial, and extremely durable. However, it is composed of a very large number of very small members, as the individual wires of a ¾-inch rope are only 50/1,000-inch in diameter. Thus a small diameter section must be made of very tough material to withstand the hard service it gets under normal use. Corrosion and wear can quickly damage and destroy it.

OPERATING CONDITIONS

The condition under which rope is used differs on shovels, cranes and draglines. The conditions determining the selection of the best lubricant are the nature of the job, climate, geographical location, and the season. Practically all the oil companies and lubricant manufacturers have in their organizations experts who are at your service to recommend the proper lubricating material for each condition and requirement. When consulting these engineers it is essential that you give them full information on the particular conditions and requirements of each case. You can expect them to understand thoroughly their duties but you can not expect them to know all about your particular problem without furnishing minute and complete details of your operating conditions.

There are particular requirements and conditions for the lubrication of each rope used on convertible power excavators which may be advantageous to discuss in detail. The boom hoist cable or "topping line" has practically the same lubrication requirements on a shovel, dragline, or crane, although it probably receives most operation on the latter. In general, this rope does very little running and therefore the principal lubrication requirement is protection against corrosion. Adequate protection from corrosion will provide sufficient protection from wear. The lubricant which is used on other rope may be used for the boom hoist cable. The hoist cable on either a shovel, dragline or crane runs continuously and, therefore, is subjected to considerable wear. This cable requires the best possible lubrication. The external lubricant will wipe off on the sheaves and drums and if external lubrication against wear is maintained, full protection against corrosion is provided. This cable needs constant internal lubrication, which should be obtained by using a lubricant that will readily penetrate from the surface through the many strands of wire to the core.

While the hoist cable has little or no contact with the ground, abrasive particles from the atmosphere will collect on it. It is likely to collect an excessive amount of dirt or grit which combines with the lubricant and forms a gummy, abrasive grinding compound over the surface, which is contrary to the purpose of lubrication. This condition can not be helped and it is impracticable to renew constantly such accumulation. The cable should be thoroughly cleaned before additional lubricant is applied. Should the hoist cable be unavoidably subjected to continuous accumulation of abrasive material, it is advisable to make frequent application of a lighter penetrating oil to insure internal lubrication.

The drag cable on a boom dragline collects the maximum amount of dirt. This cable is forced into the cut ahead of the bucket and dirt is carried up the fairleader sheaves and distributed from that point over the entire cable. This drag cable is subjected to more abrasion than is usual in any other cable service and, by reason of these operating conditions, continuous external lubrication is practically an impossibility. It is, however, particularly desirable to accomplish as effective internal lubrication as possible, largely because the boom dragline machine is so frequently in wet excavation and under almost all operating conditions considerable moisture comes in contact with the rope. One means of internal lubrication is to apply a light oil with a maximum of penetrating properties at frequent intervals. The oil should be applied when the cable is

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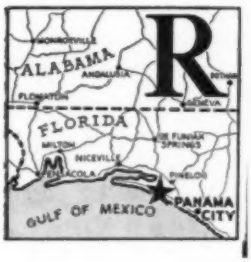
Successful Experiment *in* Road-Mix



ROAD-MIX construction is a difficult proposition at best, for every section of new material requires a slightly different treatment, method of mixing or variation of the bituminous binder. Add to this a sand that is of the ball-bearing variety so that machines had to be equipped with over-size low-pressure tires to make it possible to operate at all and you have the problem faced by the John E. Ballenger Construction Co. in the 7.5-mile contract for a 20-foot mixed-in-place top 6 inches thick and with 5-foot shoulders on Florida Route 115 about 16 miles west of Panama City, Fla.

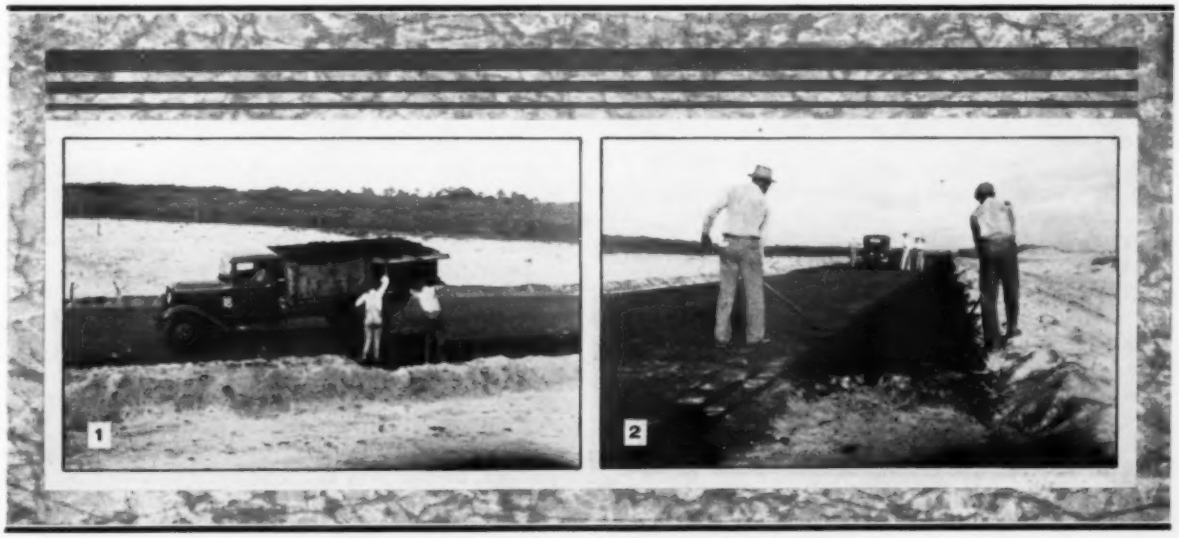
Considerable difficulty was experienced with the early sections of this work in the selection of the proper viscosity of tar, resulting in the necessary removal of some parts of the work where longitudinal cracks occurred as the result of using a winter viscosity for the early mixing. There was complete understanding and cooperation between the contractor and the State Road Department, both at the office in Tallahassee and

John E. Ballenger Construction Co. of Lakeland, Fla., Completed Difficult Sand-Bituminous Link in Coastal Gulf Highway

on the project. Had this not been the case there is some doubt whether the project could have been completed successfully. It was in the nature of an experiment as was also the adjacent section where muck was added to the sand to stabilize the material before applying the bituminous material and mixing.

Fine Grading

The contractor started April 12, 1934, with a grade that had been completed under another contract. He began fine grading with an Adams 12-foot grader pulled by a Caterpillar Fifty diesel tractor, shaping the road-



DRESSING THE SHOULDERS WITH SWAMP MUCK

1. The saddle-bag body of the muck truck, showing method of dumping. 2. The muck was hand-spread and dressed.

way to a 2½-inch crown. The two Adams graders used for this work and also used later in the mixing operation had 14-inch extensions on the wheels to permit their operation in the loose sand. These were removed when working on mixing. In addition to the tractor and grader mentioned above there were also a duplicate set and a Caterpillar Thirty-Five diesel tractor, and an Adams retread mixer.

ENTIRE ROADWAY EXPLORED BEFORE APPLYING TAR

A three-share McCormick-Deering gang plow was used over the entire length of the roadway to be mixed before any tar was applied to see if there were any roots or stumps left in the material to be mixed later. This gang plow worked the material to a depth of 10 inches and did bring up a considerable quantity of roots but no stumps. Thus the operation was worth while in eliminating what might have been a nuisance, to say the least, during the mixing operations.

HAULING TAR

Tar of 55 to 65 viscosity was furnished by Koppers Products Corp., Tampa, Fla., by tank cars delivered to Panama City, a distance of 16 miles from the east end of the contract. This tar was a petroleum tar cut back with oil and containing no naphtha. The tar was hauled from Panama City to a 12,000-gallon storage tank at the east end of the work by a Ford truck and trailer, each mounting a 600-gallon tank. A rotary pump mounted on an old truck chassis was used to transfer the tar from the tanks to the storage tank.

To supply the distributor throughout the length of the contract two Ford V8 trucks carrying 600-gallon tanks were used. In order to permit these trucks to operate over the soft sand, they were equipped with 900 x 24 Goodyear tires on the rear wheels and 750 x 18 tires on the front. These tractor-type tires held up the heavily-loaded trucks without difficulty and were used on all truck equipment that had to operate in the sand areas.

THE DISTRIBUTOR

As the distributor had to haul the heaviest load of any of the equipment, it was deemed advisable to remove the Kinney 639-gallon tank and pressure pump from the 5-ton GMC truck chassis as there were no tires available which would insure complete freedom from miring in the sand with this load. The distributor was then mounted on a pair of Euclid crawlers with six springs between the regular truck mounting frame and the standard chassis frame of the crawlers. This outfit was easily hauled over the loose sand by either the Fifty or Thirty-Five diesel tractors.

The contractor had mounted a 4-cylinder Star motor to drive the Kinney asphalt pump through a 4-inch silent chain drive to handle all pumping from the tank trucks as well as the pressure application of the tar to the roadway surface.

APPLYING THE TAR AND MIXING THE TOP

The tar was applied in five 0.3-gallon per square yard shots by the distributor, with the mixing operations carried on between each application. In applying the tar to the top it was shot the full 20-foot width of the roadway. Then after thorough mixing the graders would take a 3-inch cut and windrow the material from the center to the two sides. This was all the mixing the top received, as such.

SHOOTING AND MIXING THE BOTTOM

The removal of the top 3 inches exposed the bottom layer of the roadway and this was shot with three or four successive applications of the tar in 0.3-gallon units with careful and constant mixing between each application. The mixing was done most effectively by three 22-inch McCormick-Deering disc harrows with double discs. The number of trips for the complete mixing of any one section depended entirely on the condition of the material when the tar was applied. It was found that almost infinite mixing was of no use if the material was at all wet when the tar was applied or was rained on immediately after and before mixing could be started. The material would ball up with an apparent segregation of the bituminous material. The result was a rule to leave the mixing until the material had dried out if the outfit was caught in the rain. The application of the tar was followed immediately by the disc mixing. In fact, the harrows followed in the wake of the distributor to lose no time in the mixing.

TOP AND BOTTOM MIXED

After the three or four applications of tar had been thoroughly mixed in the bottom 3 inches, the top material which had been windrowed to the two sides was brought back by the graders and spread uniformly over the bottom course. Then a bottom plow was run along the edges of the mixed section throwing the sand from a depth of 10 inches along the edge into the roadway with the three ploughshares, turning it over for a distance of 36 inches from the edge and leaving an open space at the edge of the roadway. This edge material, containing some sand not mixed with tar because of the depth from which it was pulled, was then bladed to the center of the roadway from both sides and crowned.

Depending on the appearance of the mixture, more tar was applied and thoroughly mixed with the harrows until a suitable mix was reached, using the 3.0 gallons per square yard specified or more if necessary. During this mixing the blade graders and the retread machine with supplementary blades which permitted turning the material over six times in one passage over the section were used. At all times after the side ditch had been opened it was kept clear of the mixed material until a suitable mix was reached and then the graders spread the material to the required section, filling in the trench at the side. This was immediately followed by rolling with a Galion 5-ton gas roller.

There was usually some excess material bladed to the edge when the roadway was worked up to the stakes set by the engineers. This material was loaded by hand into trucks and hauled to convenient locations along the shoulder where they were wide, and spread and rolled for parking spaces. The very nature of the material will not permit parking on the roadway without some impression from the tires, particularly in hot weather. Further, the roadway is bound to be used by fast traffic and it is well to maintain it clear of parked cars.

In hot dry weather the contractor was able to mix one application of the top shot for a distance of 3,000 feet in two working days, leaving the road ready for

windrowing to the sides. At other times, when rains wet the grade or the mix, there were sad delays but these were not as disheartening as the balling of the mix early in the work when attempts were made under the direction of the Superintendent and Project Engineer to dry out the mix by turning it over while damp. The experience gained may be summed up in the words, "Leave it alone when damp."

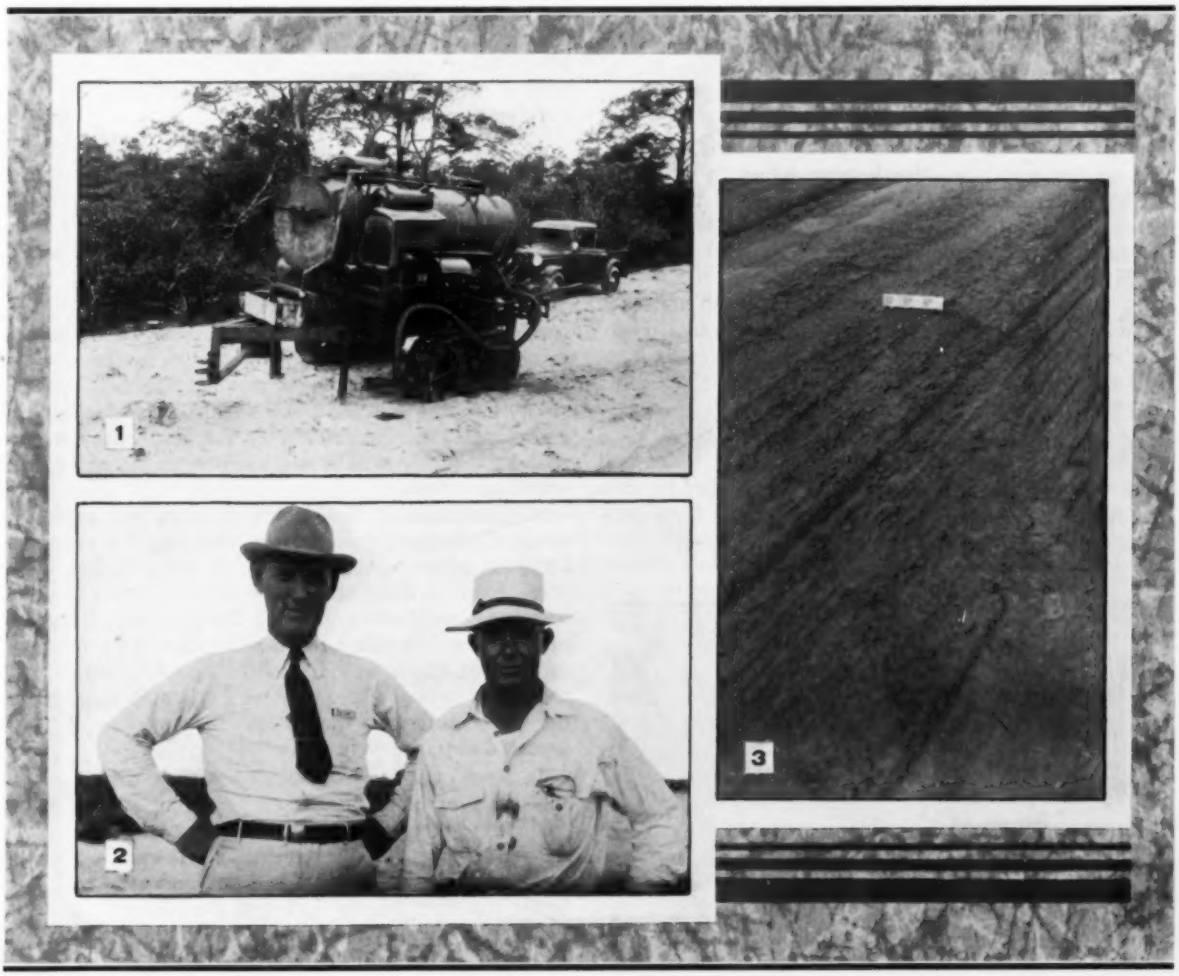
PLACING MUCK ON SHOULDERS

The 5-foot shoulders were hand-dressed with muck hauled from nearby swamp areas and seeded with grass to stabilize the shoulder. A novel and very effective truck body was built by the contractor for this work. It consisted of a double V body mounted on the flat bed of a Ford truck, making two long bins for the hand-loading of the muck on either side. There were two doors swinging out on each side to release the muck onto the shoulders and reduce the time of dumping and yet permitted more control than if one longer door had been used. There were two men spreading and trimming the shoulders and four loading the truck. The method of applying the muck was to carry one side slightly ahead of the other. The truck would drive onto a pair of planks set at the right position on the right-hand side of the road, dump the bins for that side and then pull ahead about 50 feet onto planks set on the other side and dump the left bins.

PERSONNEL

The contract for this 7.5 miles of sand-bituminous road-mix surfacing was awarded to John E. Ballenger Construction Co. of Lakeland, Fla. For the contractor, J. B. (Benny) Hampton was Superintendent. For the State Road Department of Florida, P. Reichelderfer was Project Engineer on the road-mix contract and E. C. Binkele for the grading operations of McVay Lindsay & Son which preceded the work described.

Don't forget the 1935 *ARBA Convention and Exhibit at the Willard Hotel, Washington, D. C., January 22-25. Importance has been added to the convention by the recent announcement of a proposed new four-point Federal construction plan.*



METHODS, MEN AND LABOR

1. The method of mounting the distributor on a crawler wagon chassis to permit hauling the heavy tank over the ball-bearing sand. 2. Charles M. Nolan, General Superintendent and "Benny" Hampton, Superintendent for the contractor. 3. The top after the application of 1.5 gallons per square yard of tar, thoroughly mixed and before windrowing with the graders.

Jumbos Set Tunnel Record

By
Joseph C. Coyle

A NEW record for rock tunnel driving was established on June 15, 1934 when the tunnel crew for the Mecca Pass tunnels on the main line of the Colorado River Aqueduct completed 868 feet of Tunnel No. 3 in 27 days, or 81 shifts. Tunnel No. 3 is the longest of the three Mecca Pass tunnels, the contractor for which is Morrison & Knudsen of Boise, Idaho, and was holed through shortly after the record drive was completed. These tunnels are located about 20 miles northeast of Indio, Calif. No. 3 tunnel is 4,605 feet in length, with an overall radius of about 19 feet. No. 2 tunnel is 997 feet long, with an approach cut of 100 feet, and No. 1 tunnel is 338 feet long. There is about 2,000 feet between the latter and No. 2 tunnel and about 2,500 feet between No. 2 and No. 3.

Work on Tunnel No. 3

The approach cut to No. 3 tunnel is 175 feet long and 40 feet deep at the portal, and it was necessary to open about 600 feet of access cut for a track to the dump. These cuts were largely blasted, using Ingersoll-Rand S49 jack hammers, with an I-R and a Gardner-Denver portable compressor, for the drilling, and Giant 40 per cent gelatin powder for the blast. About 12 feet of the top was cast over with a Northwest dragline, the balance of the excavation being loaded into dump trucks and hauled to the site of the blacksmith shop, where it was used for leveling.

The Jumbo in the Heading of Tunnel No. 2

This tunnel was timbered all the way with five segment sets of 10 x 10 timbers, ordinarily spaced 6 feet on centers but much shorter in bad ground. Two-inch lagging and 6 x 6-inch collar braces were used. Due in part to the shallow overburden, many slips and treacherous spots were encountered in this work, slowing up progress and necessitating extra safety precautions. In such ground, the rounds which were usually 7 feet were materially shortened, some of the timber sets being not more than 3 feet on centers, instead of the usual 6 feet. The rounds were usually comprised of 32 to 36 holes. Space was left between the forward ends of the top lagging and the arch segments to pass crown bars from behind, after the fresh top had been barred down sufficiently to admit them. This was done by inserting pointed steel in the Worthington drifters, mounted on the forward end of a "grasshopper jumbo," which enabled the men to stay under the protection of the last timber while barring down the loose top for the crown bars. When drilling, eight Worthington drifters, with Crusca steel, were operated off the front end.

In the bad spots, especial care was taken in placing the arch shots, to avoid shattering the rock above, and the shots were delayed in firing for the same reason. These methods enabled the tunnel crews to drive full face, even in unstable ground, and make a monthly average of about 650 feet, working 26 days, since last December.

The "grasshopper jumbo," which was invented by H. J. King, Superintendent of the Bernasconi tunnel, which was used in this tunnel, is somewhat shorter than similar ones used in the other aqueduct tunnels, holding four empty muck cars on the upper deck. After blasting, the grasshopper was moved up to the face and the cars raised to the upper deck over a ramp on the rear of the grasshopper, which was operated by air. This ramp was then raised to horizontal position, and a similar ramp on the front end lowered. The empties were then let down with a small cable and braking device, to the track back of the Conway mucker, ready for loading. The loads were drawn beneath the grasshopper by one of the three Mancha 5-ton mules. Cars were made up into trains which were hauled to a switch just outside the tunnel portal, where they were taken by a Plymouth 8-ton locomotive to the dump. Twenty-four Western 4-yard dump cars were used.

In a compressor house, located at some distance from the dump of No. 3 tunnel and adjacent to the portal, there were three Sullivan compressors which furnished air for drilling for all three tunnels through a 4-inch welded line on the outside and a similar line with Victaulic couplings on the inside of the tunnels. A Roots blower, driven by a 30-hp Westinghouse motor, was mounted on a platform at the portal of No. 3 tunnel and furnished air for ventilation through a 22-inch welded metal pipe. A similar arrangement was used at the portal of No. 2, using a Buffalo blower driven by an Allis-Chalmers 25-hp motor.

No. 2 and No. 1 Tunnels

No. 2 tunnel has an approach cut 100 feet long and an access cut from one side of about the same length, through which a track was laid to the dump. This tunnel is 997 feet long and timbered all the way as in No. 3. It is also being driven full face, in a similar manner to No. 3, except that a heavily-braced wooden jumbo is used, mounting Worthington drifters on the front for drilling. This jumbo has an overhang of about 10 feet on the front, which is moved up against the face, so that the upper deck furnishes protection to the men at work. An electric hoist at the rear of the jumbo was used to elevate the empty muck car while the loaded car passed beneath it. A Mancha 5-ton mule handles the cars.

No. 1 tunnel, which is 338 feet long, was driven in practically the same manner as the other two, except that Ingersoll-Rand No. 72 drills were used from the wooden jumbo. This tunnel was completed in May, 1934, and has been cleaned up, ready for the concreting.

Concreting

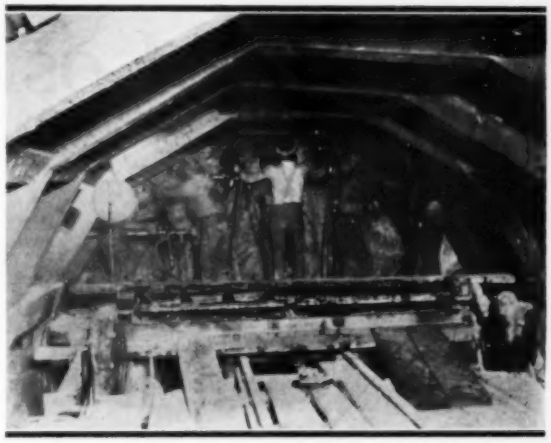
The concrete lining in these tunnels will be 6 inches on the floor and walls and 9 inches at the top. George Fortier, who was in charge of placing the concrete lining in the Du Bois tunnel at San Francisco, the Cushman Tunnel at Tacoma, the Wawona Tunnel at Yosemite and the diversion tunnel at San Gabriel Dam No. 1 at Los Angeles, will be in charge of the concreting.

The Timber Yard

One of the most important units in connection with the work on No. 3 and No. 2 tunnels is the timber station on the dump. This is equipped with an American swing saw, driven by a 10-hp U. S. motor, all mounted on a swivel post, to facilitate making sloping cuts. Wooden templates are used to gage the angle of the various cuts. At this machine also is an Ingersoll-Rand hoist, on a boom derrick, for handling heavy timbers, which are brought from the storage yard on small cars operating over a 24-gage track through the length of the shed. Nearby is a Fay-Egan band saw, driven by a 3-hp Century motor, used in cutting wedges for spreaders and for other light work. A spur from the tunnel, running along the shed, facilitates the loading of finished timbers. The installation of this equipment has made possible the efficient handling of the enormous amount of timber required in the Mecca Pass tunnels.

"Handle with Care"

Particular care was taken in handling the large amount of blasting powder used on this project. It was hauled in a special powder car from the powder house accommodating about 4,000 pounds, located some distance from the dump, where it was stored. This powder house was served by a spur track, as was another building where the primers were made up. The principal magazine, holding about 30,000 pounds, was a half-mile from the tunnel and camp. All the magazines were double-walled and roofed, with the space between filled with gravel. Openings were made and screened at the floor and roof, for complete ventilation.



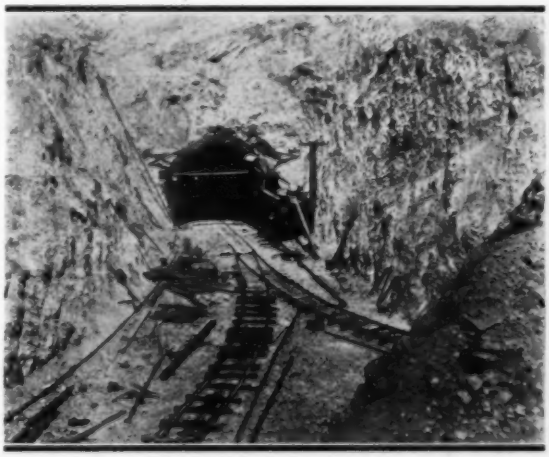
Drilling Off the Grasshopper Jumbo in No. 3 Tunnel

The Blacksmith Shop

Near the access cut is the blacksmith shop, with an Ingersoll-Rand sharpener, a Gardner-Denver forge and two Airco welding units. Nearby is the battery charging shed, equipped with two Hertner 100-ampere generators. Two spur tracks enter the shed. The mules leave their battery cases up on a sloping rack of wood, topped with channel irons, the mules being withdrawn by power from an extension cable, thus dispensing with the usual hoist for removing the cases. Near the blacksmith shop is a very complete supply house for the electrical equipment in use in the tunnels.

Personnel

The contractor for the Mecca Pass tunnels is Morrison & Knudsen of Boise, Idaho, for whom J. B. Bonny is District Manager at Los Angeles, Lyman D. Wilbur, Division Engineer and S. A. Dahlberg, Superintendent at Mecca Pass. For the Metropolitan Water District of Southern California, Frank E. Weymouth is General Manager and Chief Engineer. J. L. Burkholder is Assistant General Manager and R. B. Diemer, Division Engineer of Division 4. H. J. Mills is Resident Engineer for this project.



The Portal of No. 2 Tunnel

Are You Losing Profits *through* Lost Time?

Part III

Reported by
C. F. Rogers

Assistant Highway Engineer
U. S. Bureau of Public Roads

COOPERATION of awarding agencies in letting contracts at such times of the year that contractors are able to take advantage of weather conditions means less time lost and consequent better bids. This installment of the "Lost Time" article also discusses bin shortage and so-called minor delays which result in major losses.

Losses of Time Due to Weather

Weather is the cause of 23.4 per cent of all lost time and such delays occurred on 21 out of the 23 projects. Delays due to rain, snow, wet base or subgrade, and cold or foggy weather, are classed as major unavoidable delay. However, there is the possibility of minimizing their effect on production and unit cost by adjusting the construction season in accordance with weather records.

States should and do cooperate with the contractors in the letting of contracts so as to permit construction of high-type surfacing during the most advantageous seasons of the year. Periods of greatest freedom from time loss due to weather conditions may be determined for sections of the country as shown by Figure 5. This chart shows the percentage of available time lost due to weather on California projects for all months except June and July. The data were collected in the years 1927 to 1930 and the observations covered from 300 to 1,000 available hours in each month. No data were collected for the months of June and July. It is believed that the chart is fairly accurate for most coast and San Joaquin Valley points. The months between April and November, inclusive, had relatively favorable weather for construction. Such data can be developed for any section of the United States and the records of the United States Weather Bureau are particularly useful for such purpose.

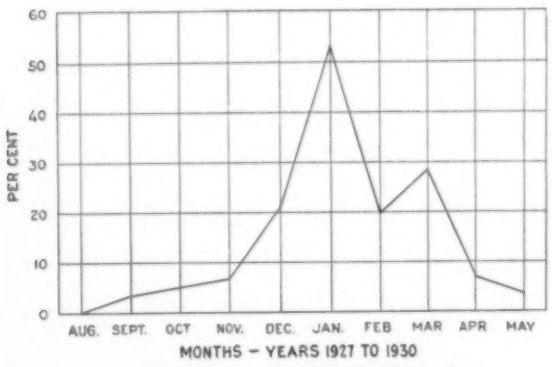


Figure 5. Percentage of Available Time Lost Because of Weather Conditions on California Projects.

Weather losses occur almost invariably as major delays, and halt rather than retard operations. On the projects studied only 76 per cent of the time available could be used as working time. Other losses which also detract from available time are found in both the major and minor classifications. Late starts in the morning and at noon and occasional early stops are not tolerated under competent supervision. A regular and consistent working day should be the rule. The occasional practice of working extra hours to make big runs one day only to suffer a corresponding loss the following day is not recommended. Asphalt paving construction requires a high degree of consistency since costs for such items as hauling units and heating of materials continue through all short delays.

The orderly delivery of purchased materials is at times beyond the control of management but frequently lapses in placing orders are observed and a loss from this cause is clearly avoidable. In one case, laxity in inspection of plant requirements led to failure of the fuel supply. In other cases failures of belt and bucket lines were not anticipated or failure to maintain a proper inventory of spare parts resulted in prolonging delays. In general, such delays have been classified as partly remediable. Their prevalence indicates that the plant management should definitely place responsibility among employees for keeping up stocks of materials, supplies and spare parts, and anticipating breakdowns of units.

Preventable or partly remediable delays were recorded on more than half of the projects studied. Uncommon delays, principally accidental in character but not infrequently due to carelessness, also resulted in loss.

A Study of the Factors Resulting in Time Losses in the Construction of Mixed Bituminous Pavements Made by the Division of Management, U. S. Bureau of Public Roads

of production. The explosion of a boiler, destruction of plant by fire in two cases and the accidental death of an employee are typical examples. These were classed as miscellaneous delays.

All these delays, common and uncommon, fortuitous or otherwise, indicate the need for alertness, since they robbed 23 contractors of 12.3 per cent of their available time.

The total loss of 4,553 hours on 23 projects because of major delays is a serious one. However, major delays generally result in cessation of operation, and are therefore usually accompanied by a partial reduction in cost of labor, fuel, etc. With minor delays such is not the case. Minor delays appear in the countless repetitive operations where a single loss of time is of negligible moment but when regularly repeated they amount to a considerable portion of the working time. They occur under full operating costs and are of greater importance than idling costs to the extent that hourly operating costs exceed hourly idling costs. Most minor delays are avoidable.

"Bin Delays" Outstanding as a Cause of Minor Delays

The outstanding minor delay is "bin shortage" caused by inability to furnish aggregate to multiple bins in the proportions required in the mix. Failure to do this results in shortage in one bin or overflow in another. Bin shortage accounted for the loss of more than 613 hours on the 23 jobs and was found on every project. On recent jobs under good management definite steps were taken to reduce this loss with excellent results.

When aggregates are fed to the elevator in proportions differing from those required in the mix a shortage is bound to follow in one bin or overflow in another. Where the different sizes of aggregate are combined when delivered or are combined in stockpiles or bunkers at the plant there is always more or less trouble with bin supply. Complete separation of each required size in stockpiles is a first essential to the necessary control. With the necessary sizes readily available the problem can be completely solved by proper functioning of feed controls.

Figure 6 shows several different methods of feeding

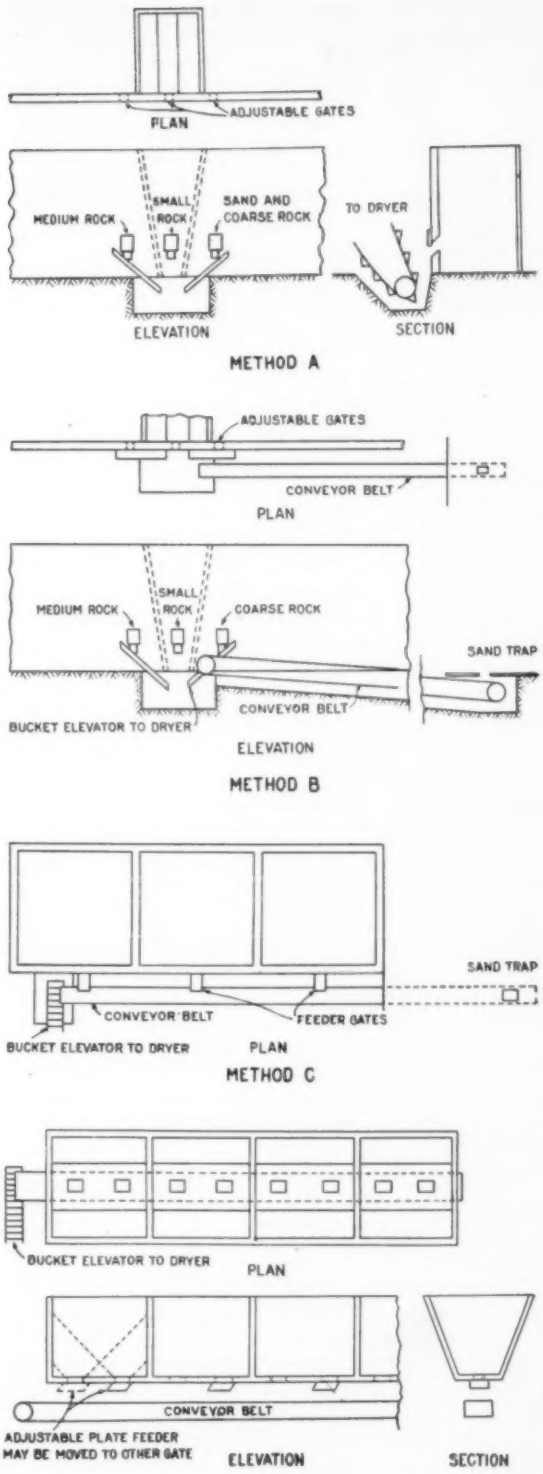
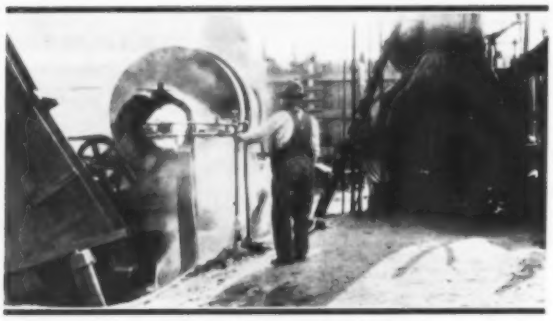


Figure 6. Methods of Feeding Aggregate to the Elevators.

aggregates to elevators. At one plant the method of handling was as follows (Method A): four sizes of aggregate were required. The materials were stored at



A Typical Heater Arrangement

ground level against a bulkhead with two partitions to provide three bunkers. Sand and the largest size of rock were combined in one of these bunkers according to the judgment of the crane operator while the other two were filled with correctly separated sizes. Adjustable vertical gates in the bulkhead permitted materials to flow to a pit where they were picked up by the cold elevator. The gates were adjusted from time to time as the need was indicated. Bin conditions were indicated by a system of rope "feelers" and visual signals. The sand was mixed with coarse rock to overcome the resistance of sand to flow. The control of the two mixed sizes was not positive and the feeding of the small stone through vertical gates was not entirely satisfactory.

Another plant was operated on the same general plan except the sand was stored in a separate bunker with a sand trap feeding a belt conveyor which deposited the sand in the elevator pit (Method B). Here there was also difficulty with the vertical gates and a need for constant alertness in regulating the controls.

Improved operation was observed at a third plant with four raised bunkers feeding a belt conveyor in front of the stone bunkers and beneath the sand bunker (Method C). Sand was fed through a trap and stone through angular sloped feed gates. Rate of feed from bunkers could be observed while inspecting the conditions of bins—a considerable advantage. Such an installation costs more than those previously described but the cost was more than offset by the saving in working time.

A fourth method gives such positive control as practically to eliminate bin delays (Method D). It consists of four bunkers placed over an excavated and shored tunnel in which a belt conveyor is placed. Each bin has two gates in the bottom which are used alternately to induce breaking down of reposed material. The open gates drop the material to an automatic, power-driven plate feeder which can be set to deliver material in the exact quantity desired. On the job where this arrangement was used it practically eliminated bin delays and the savings thus effected were considerably more than the cost of the installation. In 100 hours of operation bin delay amounted to less than one tenth of 1 per cent.

DELAYS FROM SHORTAGE OF HAULING EQUIPMENT OF CONSIDERABLE IMPORTANCE

Next in importance to bin delay is the time loss arising from a shortage of hauling equipment or faulty operation of hauling units. Some loss of this type occurred on every project and such losses accounted for 657 hours on all projects or 5.2 per cent of the total available time. Time losses arising from hauling are thought to be largely avoidable since they occur most extensively on poorly managed work. On four poorly managed jobs, hauling equipment delay varied from 16 per cent to 24 per cent of operating time, whereas on four well managed projects, it was reduced to less than 2 per cent and on one of these jobs to less than one-tenth of 1 per cent.

Frequently, it is difficult to determine whether a delay is the result of shortage of hauling units or to road conditions. Timing of the hauling units should indicate the source of the trouble and the remedy to be applied.

Delay resulting from hauling operations may have its origin in faulty plant arrangement, failure to provide sufficient storage of mixed batches, poor and indifferent operators, poor equipment, bad roads, traffic interference, lack of correlation between plant and road capacity, or may be due to an insufficient number of hauling units.

The routine operation of taking on the load at the plant should be smooth and systematic. Oiling of bodies should be done at necessary stops on the plant loop. Nearly all plants are equipped for storage of one or more truck loads of mixed material, but some contractors delay truck operation by requiring trucks to wait and receive batches as they are mixed. Trucks should pass over a loop at the plant and should not be required to back in turning or to reach the loading point. Scales for weighing should be on the most direct route from the plant to the job. Experienced mechanics should be at hand to correct promptly mechanical troubles with the hauling equipment. Roads should be regularly maintained and some conditions may require constant maintenance. The value of increased travel speed will more than pay maintenance costs.

Equipment and personnel on the street or road should be sufficient to handle the production of the plant without delaying trucks in depositing loads.

Often, failure to provide an adequate supply of hauling equipment is due to inability to determine needs rather than to inability to obtain an ample supply. To assist in rectifying this condition, contractors are frequently furnished hauling charts, graphically simplifying the determination of a proper supply. Figure 7 is a Z-type nomograph designed particularly for use on asphaltic concrete work and based on the formula $N = \frac{Q}{60W}\left(\frac{10{,}560L}{S} + T\right)$. The symbols are defined below. Instructions for use are given on the chart and the steps in the progressive solution are numbered correspondingly. The application of this chart to a specific problem is shown by guide lines. To arrive at a solution for a particular job it is necessary to know the length of haul, L; the usual average round-trip speed of units on the road, S; the time constant which is the total time consumed in performing necessary operations other than travel, T; the capacity of the hauling unit, W; and the plant capacity, Q. The number of trucks required for any length of haul up to 17 miles may be determined with this chart.

The shorter the haul the larger is the relative importance of the time constant. Large hauling units have

a greater time constant but the frequency of occurrence is less. Figure 7 may also be used to determine the economical size of hauling unit. The number of trucks required may be determined for alternative sizes, using the operating constants for each size of truck. Knowing the number of trucks required the total cost may be determined from the cost of ownership or rental of each size. On the projects studied, loads carried varied from 1.17 tons to 6.57 tons and the lowest unit cost was produced by the largest trucks.

Hauling cost is sufficiently important to justify analysis before the job is begun. Careful advance planning is very likely to result in substantial savings. The possible economy of an extra plant set-up for the purpose of reducing average haul distance should be investigated. It should be borne in mind that total hauling cost is the summation of daily costs while hauling at varying distances and that calculations based on the average haul distance are misleading. Occasionally it has been found uneconomical to furnish the hauling equipment necessary to maintain full plant production on extremely long hauls. However, it is believed that a careful comparison of the cost of an additional plant set-up with the additional hauling costs and losses in plant production will often indicate the desirability of moving the plant in such cases.

MANY MINOR DELAYS CAN BE EITHER MINIMIZED OR PREVENTED

Delays at the plant include those classed as "mechanical" or failure of machinery to function properly; "operative" or failure of labor to function properly; "handling aggregate" (exclusive of bin delays); interruption of operation to inspect or change the mix; and a variety of miscellaneous short delays of infrequent occurrence. Such minor delays accounted for a total of 4.34 per cent of all working time, a matter of 550 hours.

Many mechanical failures could not reasonably have been anticipated. However, careful, periodic inspections will accomplish a definite reduction in the frequency of breakdowns. The maintenance of carefully inventoried stocks of repair parts such as chain links, belt laces, pipe line connections, cables, dipper or clamshell teeth and gear sprockets has proved to be low-premium insurance.

Operative delays occur as the result of failure of a particular machine to keep up with the pace which can be set on the rest of the job and may be due to inadequacy of the machine itself or to the manner in which it is operated. A study of time records is convincing that the majority of such delays are the result of habits of operators which can be corrected. It is as easy for operators to form the habit of consistently maintaining output at the capacity of the machine as it is to fall into careless operation which is perhaps affected by another equally careless operator at another machine. Such operation is most often due to lack of thought rather than indifference. The high cost of operative delays makes it desirable to place skillful operators in key position at wages commensurate with the responsibility of the position.

Delays incident to handling materials may occur at any point along the line of progress through the plant. Adequate crane capacity is essential and must be accompanied by good operation or output will suffer. A poor machine with a good operator or a good operator and machine with a poor arrangement of facilities for unloading, stockpiling and feeding to the dryer, may fix the limit of production considerably below that attainable in other parts of the plant. Reference is again made to Figure 1 (in Part I of this article) which shows a typical, orderly arrangement with the crane runway between spur track and stockpiles and within easy reach of all sizes of aggregate. With proper arrangement of facilities, the ordinary ¾-yard crane is suitable for production up to 1,200 tons in an 8-hour day of plant operation.

(To Be Continued in January)

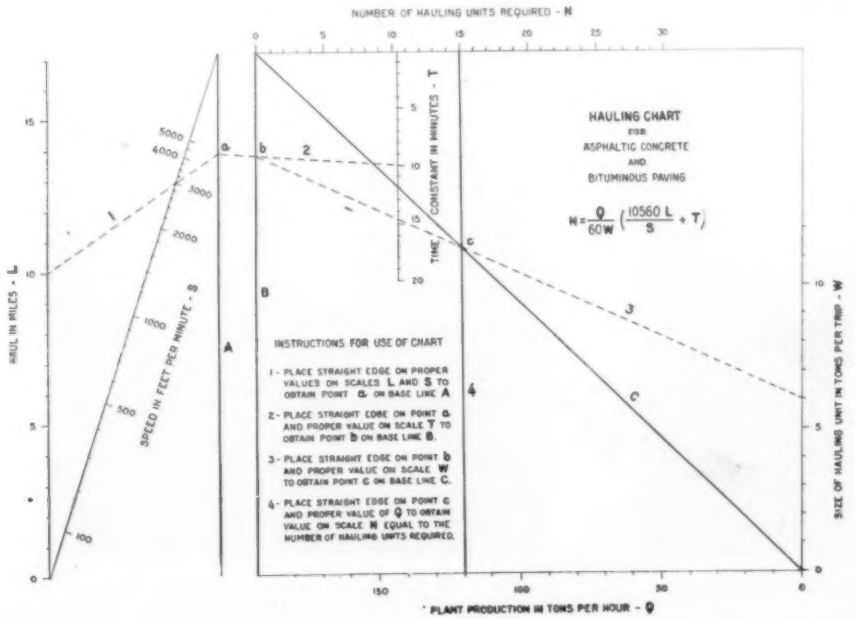
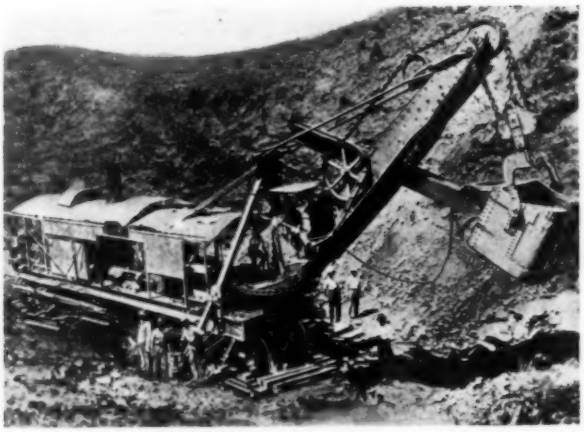

NUMBER OF HAULING UNITS REQUIRED - N
HAUL IN MILES - L
SPEED IN FEET PER MINUTE - S
TIME CONSTANT IN MINUTES - T
SIZE OF HAULING UNIT IN TONS PER TRIP - W
PLANT PRODUCTION IN TONS PER HOUR - Q
HAULING CHART
FOR
ASPHALTIC CONCRETE
AND
BITUMINOUS PAVING
$N=\frac{Q}{60W}\left(\frac{10560\,L}{S}+T\right)$
INSTRUCTIONS FOR USE OF CHART
1 - PLACE STRAIGHT EDGE ON PROPER VALUES ON SCALES L AND S TO OBTAIN POINT a ON BASE LINE A
2 - PLACE STRAIGHT EDGE ON POINT a AND PROPER VALUE ON SCALE T TO OBTAIN POINT b ON BASE LINE B.
3 - PLACE STRAIGHT EDGE ON POINT b AND PROPER VALUE ON SCALE W TO OBTAIN POINT c ON BASE LINE C.
4 - PLACE STRAIGHT EDGE ON POINT c AND PROPER VALUE OF Q TO OBTAIN VALUE ON SCALE N EQUAL TO THE NUMBER OF HAULING UNITS REQUIRED.

Figure 7. Diagram for Determining the Number of Hauling Units to Use for Economical Operation

The First Marion Steam Shovel—Barnhart Style "A," Built in 1884



A Marion Type 91 *Which Broke the World's Record at Panama*

Fifty Years *of* Shovel Construction

IN 1883 an important advance in steam shovel design was made in a machine developed by Henry M. Barnhart and Edward Huber, of Marion, Ohio. Henry Barnhart had charge of the carpenters and bridge builders, and exercised supervision over the gravel pits from which ballast was taken for the road bed for the Chicago & Atlantic Railroad, now the Erie, near Kenton, Ohio. The machine used in one of the gravel pits lost much time because there were only a few men around the job capable of handling the machine. One day, when the entire crew was waiting for the operator, Mr. Barnhart climbed on the shovel, operated it and soon discovered weak points which he made it a point to eliminate in a model he designed shortly after. The first new shovel was built early in 1884 and sold to the Cincinnati, Jackson and Mackinaw Railroad Co., to be placed in service in a gravel bank near Greenville, Ohio. On August 4 ,1884, shortly after the first shovel was built, the Marion Steam Shovel Company was incorporated and construction of a plant started. Even before the plant was completed, it was necessary to build a second shovel and the third, a repeat order, was the first to be built in the new shop.

In reviewing the rapid strides that have been made in contracting since the advent of the power shovel, it is difficult to realize that so much has been accomplished during the past 50 years. Yet the development of the power shovel has paralleled and kept pace with the contracting industry in every respect. The Panama Canal was the greatest excavation project of its day and there on May 6, 1912, a Model 91 Marion shovel established a record of 5,554 cubic yards of material. The New York State Barge Canal, flood control on the Mississippi River, subway construction in New York and other cities, the great Hoover Dam, TVA work, the Fort Peck Dam and other projects have shown to the world the stamina and service of power shovels in construction.

A Shovel on Traction Wheels in Road Construction in 1912

A Type 371 *Excavator,* 1934 *Vintage, with a* 1¼*-Yard Capacity*

Production Methods Used in Welding *for* Construction Purposes

By
G. E. Deatherage
General Superintendent of Construction, Whiting, Indiana
and
J. B. Latterner
Chief, Planning Department Construction Division Carbide & Carbon Chemicals Corp., South Charleston, W. Va.

IN industrial plants where fluids and gases are processed at high temperatures and pressures, the piping must be designed and constructed with the same care as the pressure vessels which the piping connects. Thus when piping is fabricated right on the job during the construction of a plant, it becomes one of the most important jobs the field forces have to do. If it should be a chemical plant containing a maze of piping, interconnecting practically every piece of equipment in the place, the fabrication and erection of the piping becomes by far the most important field operation, worth the unceasing attention of the construction superintendent.

On a well-organized construction job, the erection of lines is pushed aggressively because of other work waiting for the completion of the piping. A delay in the installation of some one line might interfere with the completion of a half dozen related jobs, and this could not be tolerated. The organization must be such that pipe materials are received, fabricated, and the piping erected in accordance with a general construction schedule without jamming any one department with more material or work than can be handled, and without having an overmanned labor crew.

In the construction of various units of a large chemical plant in West Virginia, we early recognized the important part that the piping organization played in the rapid and economical completion of the job. Over a period of years detailed and efficient procedures for pipe fabrication and installation have evolved from our interest in this phase of the work and our constant desire to improve on past practice. In so far as possible it has been our aim to bring together into a single systematic organization the many miscellaneous activities found on a construction job—to put field work on the same basis common to most all shop production layouts.

Most Joints Ox-welded

In our piping work all joints that possibly can be are ox-welded, hence the piping organization is built entirely around the oxy-acetylene process to take the fullest advantage of this versatile method of joining pipe. Welding was adopted originally for piping and pressure vessels for reasons of safety and freedom from maintenance. Cost was a factor little considered. Today if it should be found necessary to do without welding, we are confident that the cost of piping in place would be greatly increased and, what is even more serious, the over-all time for completing a job would be greater. This is because welding has made practicable "made to measure" fabrication and erection of a complete piping job. In the eyes of the construction superintendent this is probably the most important single contribution of welding to construction practices because it greatly simplifies the task of putting field work on a systematic basis. It puts piping installation in the same class with structural steel erection, where members are fabricated to exact dimensions in the shop and are fitted together orderly in the field, in complete coordination with other portions of the construction program.

Plan of Operation

The plan of operation built around the "made to measure" idea is the logical outcome of experience gained on a number of jobs and the recognition of certain basic facts.

The six factors around which the plan of operation is laid are: (1) shop fabrication of all lines in good-sized sections, with assurance of ready assembly in the field; (2) giving each individual in the organization a minimum number of duties, to the end that efficiency is increased; (3) giving the key workman in the organization, the welder, nothing to do but welding so that quality and production will be uniformly high; (4) considering the entire piping job as divided into a number of unit lines, each a separate item of equipment; (5) placing the responsibility for all welding, because of its importance, under a welding foreman; (6) and performing the greater part of the welding in the shop where it can be done economically and speedily.

How the Plan Operates

With the welding department uppermost in mind,

let us see how the plan operates. First to be considered is the origin of requests for the welding crew to do work. Generally the requests are in the form of standard pipe sketches or shop drawings forwarded to the welding shop from the general mechanical foreman as authority to commence work for new construction. However, they may also be shop orders for doing work not contemplated in the original design, and requests from other departments such as the erection department for operators to do tie-in welding in the field.

No work is done except by authority of some such job order—pipe sketch or shop order—from the general mechanical foreman. It is important to bear in mind that each job is considered a unit of work—a definite job usually requiring the services of a single welder and his helper. The job may call for the fabrication of a header, or the tack-welding and welding of nine joints required in erecting a line in the field. Each such job is of course chargeable to a given line, and therefore no job order concerns more than one line.

Job orders as received are recorded in a "Works File" and a "Works Calendar File" by the welding clerk who is an assistant under the welding foreman. The Works File is simply a blank form in which all needed information about a particular unit of work, the job order, is recorded as the job progresses. The status of any job order at any particular time is thus made available. Provision is made on the form for the number of the line for which the work is being done, the date wanted, the number of the bill of material which was authority for material to be purchased for this particular portion of the job, when the material was received, when the job was started and completed, the number of the welder and his foreman, the welding time, results of the tests and disposition of the work upon completion—whether it was placed in storage temporarily or sent direct to the job.

The date wanted is important and will usually be determined by the date the material is scheduled to arrive on the job, this date being supplied by the Bill of Material which is available to the welding clerk along with the job order. If the work happens to be field welding and is not covered by a Bill of Material, the date wanted is secured from the field job order.

The job order is then assigned a date in the Works Calendar File in either of two ways. If the material needed for it has been received or if no material is required, the job is assigned to the "active" Works Calendar File under the date it is wanted. If the material required is still to come, the job order is listed in the "Pending" Works Calendar File. In this way the work is mapped out a week or more in advance. Should material not arrive in time it can be checked up before the work is actually to start, and if the work scheduled for a certain date is more than the existing organization can take care of, additional workmen are secured or some of the work is advanced to a later date.

Material Kept Moving

The next step is to get the material moving to the welding shop that will be needed there on the following day for the shop jobs scheduled on the calendar. This is attended to by the welding clerk who forwards to the main receiving warehouse the Bills of Material covering the work which is to be done. In this way overcrowding is eliminated in the storeroom at the welding shop because the material is received just a short time before it is due for fabrication.

At the time the welding clerk orders material such as welding fittings moved from the main warehouse, he sends a copy of the Bill of Material to the welding shop storeroom so that provision can be made to handle the material when it arrives. Material from the main warehouse is delivered to the welding shop storeroom in open-top boxes, each box tagged with the work order number and the Bill of Material number. The boxes are arranged in the order of the Bill of Material number so that when needed each can be readily located.

At the start of a day's work, the welding foreman takes the various jobs scheduled to commence on the particular day and assigns them to his various subforemen, taking into consideration work not completed the previous day. As explained previously, the authority for a particular job is either a shop drawing or an order to do welding in the field, the one a blue print and the other a form with the reverse side blank. Before these are given to the subforeman, they are rubber stamped on the back with a special form.

Routing the Job

Information about the routing of the job is recorded in this form from the time it is assigned until the testing is completed and it is sent to the storage yard or to the job. This rubber stamped form also calls for the name of the subforeman, the number of the welder and the workman who applies the test, the date given to the welding foreman, the welding time, testing time and final disposition of the work. For welding jobs not in the shop area, space is provided on the form for the name of the field foreman to whom the welder is to report and the time he was away from the shop.

The job order with the form stamped on the back is passed from workman to workman as the job passes through the shop and the stage of the work at any particular time can be readily learned.

The welding subforemen assign the jobs to various welders under them in sufficient time for the welders' helpers to get the pipe and welding fittings necessary from the storage area, eliminating any break in the flow of work. When a job order is presented at the welding shop storeroom for the welding fittings and flanges required, a list of the pipe called for on the order is immediately forwarded to the pipe yard so that the exact lengths needed can be made ready. The welder's helper is given a duplicate copy of the order to the pipe yard so that he can pick up the pipe as needed.

Responsibility Fixed

A record is kept of welding time and all welds are stamped with the welder's assigned number to fix responsibility for the welding and time consumed. Each section of a line fabricated in the shop is also marked with the correct order number, number of the line and a number identifying the particular section.

The work is tested in accordance with its service requirements, after which it is held temporarily in a storage area or delivered to the job, depending on how soon the particular line is to be erected.

FIELD WORK

For welding jobs outside the shop area the welder assigned to the work takes the order and gets his equipment and welding supplies to the job with the cooperation of the welding clerk who arranges in advance for the necessary transportation. The welder does the work specified, stamps the welds with his number, and returns to the shop. If the subforeman believes it necessary, he accompanies the welder to the job to see that the work gets under way and is performed in a satisfactory manner.

The field foreman to whom the welder reports for work records the time of the welder's arrival and departure on the back of the job order and gives the welder any instructions he may need in the performance of the work. He also notes whether the work was satisfactory and complete, and gives the job order to the welder to be returned to his subforeman.

The job order is finally returned to the welding clerk with complete information in the form stamped on the back. He transfers as much of the information on the back of the job order to the work file as necessary, and passes the job order along to the general mechanical foreman which is notification to him that the work has been completed.

NO VERBAL ORDERS

These records required on welding work in the shop and field are relatively simple to keep and definitely fix responsibility for each step of the work. No orders or requests are given verbally in following this procedure and in the memorandum system followed, all work, of whatever type performed, whether trucking, testing or welding, is chargeable to some job. In this way cost accounting is also greatly simplified.

The care used in routing pipe and welding fittings on the job to eliminate holdups on account of material shortage has already been mentioned. Similar care is exercised in the handling of welding equipment and supplies. To each welder is issued a set of tool checks, one of which he gives up to the toolroom clerk for a kit of tools, another for a welding outfit and the others for any special equipment he may need.

Welding supplies such as rods, flux, etc., are charged to the proper line number. It is relatively easy to estimate the amount required for the job since the number and size of the welds can be taken from the job orders. Each job order of course refers to a particular line. To make sure that there is never a shortage of welding supplies, material is reordered just as soon as the inventory gets down to a minimum figure determined upon.

Various daily and weekly reports are required of the welding foreman and his men in order that the construction superintendent may know about the progress and quality of the welding. One of these is a daily report on the welders covering the estimated welding time for the previous day compared to actual welding time. Another is a weekly report on welders covering estimated welding time compared to actual welding time and in addition the number of hours worked to date on pipe welding per leak for each welder.

WEEKLY REPORTS CHECK ON PROGRESS

A weekly report on the amount of work going through the welding shop calls for an estimate of the number of hours of uncompleted work held over from the previous week, estimated hours of work scheduled for the current week, the probable actual number of working hours and the balance which will have to be carried over to the next week. In addition the hours scheduled for the next week are reported, from which the number of welders required can be estimated. A welding service record is maintained for each welder so that if he should leave the company but be considered for reemployment at a future date, his past record would give specific indication of his ability.

FACTORY METHODS FOR CONSTRUCTION

In building up a smoothly running organization we have had one paramount thought in mind: that the American factory industrial system of specialization and planning has produced really astounding results in the manufacture of quality products at low cost, and that the same idea can be applied in large degree to field construction practice.

Field construction activities in the past were left almost altogether in the hands of the foreman. He personally supervised listing, material needed, securing it from the storehouse, fabricating it and putting it in place. The construction foreman for years was the king-pin about which all activities revolved. This was the condition requiring change.

In discussing organization, we do not pretend to present anything new as far as fundamentals are concerned, but only the application of fundamentals we have made to piping construction wherein welding was the major tool employed.

Prepared from a paper presented at the Thirty-Fifth Annual Convention of the International Acetylene Association.

Are Your Trucks Prepared for Winter?

IT costs about $5.00 to prepare a motor car for cold weather, and a little more for trucks. Such expenditure gives you an opportunity to reap great returns in the form of lower repair bills, reduced motoring costs, etc. It costs only a bit more to get your motor trucks ready for winter service.

Preparation of a motor vehicle for winter according to the American Automobile Association should include changing to a lighter oil, adjustment of the carburetor to assure a richer mixture of fuel, adjustment to the ignition system particularly the breaker points, checking of the battery, brakes, and tires, and cleansing of the cooling system preliminary to putting in an anti-freeze. These things are particularly important for motor vehicles that have been in long service, especially if the service has been severe.

In order to protect the motor vehicle against freezing, the A.A.A. has outlined in three paragraphs the most important precautions:

1. Remove all scale and rust from the engine jacket, radiator and other parts of the cooling system. This should extend to the water hose and it should be disconnected and cleansed with a washing solution, preferably one containing soda.

2. Tighten all parts of the cooling system. Particular attention should be given to hose connections, gaskets, expansion plates, drain cocks, pump packing, grease cups and fitttings on the water pump. The radiator should also be inspected for leaks and necessary repairs made.

3. Use one of the standard anti-freeze solutions.

How the Other Fellow Did It

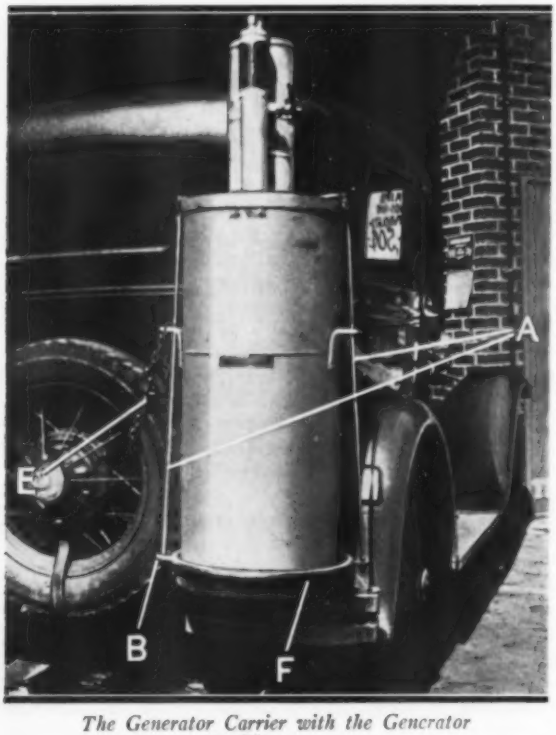
Ideas That Have Already Proved Helpful to Contractors

An Acetylene Generator Carrier for Automobiles

343. Contractors will be interested in a handy method of carrying a portable low-pressure acetylene generator which has been devised by some one with an inventive turn of mind. In the illustration showing the generator mounted on the back-end of a car, two 5/16-inch steel rods, marked *A*, hold the generator securely in the holder, *F*, which is an old brake drum. One end of each rod is hooked, so that it can be slipped over the top of the outside section of the generator. The other end of each rod is threaded. After the hooked ends are attached to the top of the generator, the threaded ends are pushed through 5/16-inch holes in the lugs *B*, which are welded on the brake-drum. Nuts hold them tight. *E* is a chain attached to the handle of the generator and to the spare wheel. It keeps the generator from swaying.

A small piece of steel bar was welded to the back part of the inside of the old brake drum. Its function is to keep the generator from sliding forward. Then a steel bar 5/16-inch thick and 2½ inches wide replaces the standard bumper-brace, which could not carry the extra weight.

In the diagram showing the construction and assembly of the drum-support, 1 is a steel bar, ⅜-inch by 1½ inches, long enough to reach from the end of the top bumperette at 2 to the main support 3 of bumperette at 4. Bracket 5 is added as shown on topside view, being bolted between the top bumper and the bumper-support 3, and also to the lower bumper. The bar 7 is the brace running between the right-hand and left-hand bumperettes. To it, at 4, are bolted the bar 1, the support 3, and the bracket 8.



The Generator Carrier with the Generator in Place

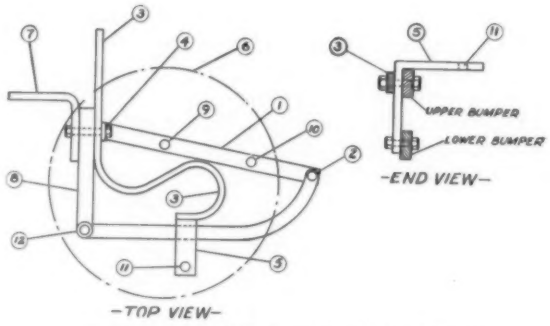


Diagram of the Construction of the Generator Carrier

In bar 1 are two holes, 9 and 10. In bracket 5 is a hole 11. In bracket 8 is a hole 12. These holes hold the bolts that fasten drum 6 (dotted lines) to the bumperette. This handy device has been tried out and works excellently. OAT 8.34

Team Patrol Salvages Tools

344. On a Louisiana contract, in the afternoon the superintendent sends the team which during the moring brings up all the forms used in the previous day's run down the entire length of the job to pick up all the tools that have been dropped by the different labor gangs during the day. It is amazing the collection which is brought in on some days. This salvaging of tools before nightfall well pays for the half-day's time of the team and driver. 27.3.19

Device Increases Accuracy of Center Steel Setting

345. For setting center steel accurately, about the simplest device we have seen was used on a contract in Louisiana. The device consisted of a 1½-inch pipe slotted at the outer end to fit over the steel forms and with a slit at the inner end to drop over the center steel and set it at the proper distance from the forms. The tubular form of the pipe made it resistant to bending and being of metal, it withstood many of the shocks which might quickly snap a wood gage. 27.3.17

A Specially Prepared Form Trench a Profitable Investment

346. A contractor in western Pennsylvania has developed a scheme that he thinks really saves money in giving him a uniformly smooth slab. He goes right back to first principles and says that the smoothness of the finished pavement is largely determined by the form trench and the firmness of the foundation furnished for the steel road forms. The trench for the forms, after being cut by hand labor, is spread with granulated slag brought up by wheelbarrows and compacted by hand tamping. This contractor has used this method for many years and has found it much easier to get the grade of the forms true at the start with a certainty of holding this grade with the heavy finishing equipment than with any other method. He says that a carload or two of stone dust can usually be bought cheaply as it is a drug on the market at all times and he finds the investment a profitable one. 27.5.22

Novelties in Handling Bulk Cement

347. A contractor operating recently in Indiana devised a very interesting method of weighing and handling bulk cement to supplement the commercial system which he also used. He made up the cement batches in containers consisting of old oil drums. These were enlarged with a 6-inch collar at the top to permit the cement to be loaded and dumped without spilling. For moving them loaded from the cement car to the platform scales located in the center of the runway, the contractor devised two-wheel trucks with arms which fitted the axles on the drums and picked them up just enough to clear the floor when moving. The 1¼-inch axles were located at about one-third the height of the barrels from the bottom and were reinforced with cleats of strap iron which hooked under the bottom of the drum and extended just above the axles. The axles were run through these cleats so that the bottom of the drum carried most of the load and the cleats prevented the axle from tearing the metal of the drum itself. Another feature was the fact that the platform scales had a section of subway grating for the platform instead of the usual wooden platform, thus preventing a not unusual accumulation of cement on the platform itself. The hole for dumping the barrel containers into the cement boxes carried by the trucks was a wooden box lined with sheet metal, and the bottom was constricted with old inner tubes from trucks. A stop on the frame of the dumping hole caught the axles of the cement barrel and two dumpers turned it over readily. Most of the weight of the barrel and its load was taken by a 2½ x 2½-inch angle iron across the hole. 27.4.23

Scheme for Holding the Cap Snug to the Expansion Joint

348. A novel and inexpensive method for holding expansion joint material inside the setting cap and snug against steel bulkheads has been developed by an Ohio contractor. The cap, which is part of the bulkhead, is drilled horizontally at twelve points across its entire length, giving twelve places where the nails can be pushed through the expansion joint material, holding it tight while it is being handled prior to placing on the road. It also insures that the top of the joint will be at the surface of the pavement when the nails are pulled just before the bulkhead is removed. 27.5.23

Longer Booms on Pavers Save Time

349. Manufacturers are recognizing the needs of contractors by lengthening the booms on their pavers. Today a number of contractors are using 25 and 28-foot booms so as to cut down the number of moves necessary in a day and also to leave the pit clearer for a greater length of time for the placing of the center steel. The long boom is also a distinct advantage in laying multi-strip pavement as it is possible to pour Number 3 strip while running on the grade in Number 1 strip during the time that Number 2 strip is still too green to carry batch trucks. Give some thought to this and we believe you will find that it will prove very economical to lengthen the boom on your paver, too. 27.4.24

Carrying the Strike-Off Over Expansion Joints

350. To prevent disturbance of the top of an expansion joint by a strike-off, an Ohio contractor set a pair of wooden arcs or risers on the steel forms at the location of the joint. These arcs permitted the strike-off to ride up over the joint. The arcs were of wood and measured about 3½ feet long and 4 inches high. Metal clips, two on each side, held the arcs in place while the strike-off was being pulled over. The concrete was struck off 1½ inches below the top of the forms for the placing of the reinforcing and was pulled forward by a Thirty tractor. 27.5.24

Agitator Trucks, Concrete Buckets and Power Shovels Pave Road

351. The use of agitator trucks in conjunction with concrete spreaders is now generally accepted as a means of speeding up paving. A southern contractor, however, used agitator trucks and a concrete bucket attached in place of the dipper of a power shovel for paving about 2 miles of highway. The agitator trucks backed up on a ramp adjacent to the slab being poured and delivered the concrete to a 1⅛-cubic yard concrete bucket which replaced the standard digging bucket on the power shovel. A one-quarter swing placed the bucket over the grade where one man dumped it and one puddler completed the spreading on the 10-foot strip. This was followed up with a mechanical finisher. The contractor unloaded, spread and finished one 3-yard truck load of concrete every 3 minutes. 27.2.30

The Lubrication of Wire Rope and Chains

(*Continued from page 24*)

dry and after the application is completed the cable should be wiped off as carefully as possible so as to leave no surplus oil on the exterior surface to which dirt would adhere.

"Do's and Don'ts"

What is known as ordinary black oil should never be used as a lubricant for wire rope. This oil has little or no value for this purpose, as it does not cling to the surface, penetrate to the core nor resist the effects of moisture or other damaging elements. The rope should be thoroughly cleaned before fresh lubricant is applied, that any dried lubricant, dirt, etc., which might otherwise prevent the lubricant from properly penetrating may be removed. Wire rope may be cleaned by scraping and the use of a wire brush. After cleaning the rope should be thoroughly dried before new lubricant is applied.

The Care of Chains

Hoisting chains or link chains of like character do not require lubrication as much as they do protection against corrosion. This protection may be acquired through frequent and thorough applications of used crankcase oil, or if constantly exposed to water or excessive moisture, may be coated with a wire rope lubricant, brushed on by hand.

Silent chains used for transmission purposes should receive careful lubrication. If the chain drive is run in oil-tight casing the lower side usually dips into an oil bath. For this purpose a good quality of oil having a viscosity of approximately 275 seconds at 100 degrees F. should be used. To the oil finely powdered graphite should be added in the proportion of about four teaspoonfuls to each quart of oil. Some units are equipped with oil pumps for spraying the lubricant to the inner or working side of the chain. For open chain drives a lubricant of a semi-fluid nature should be used. This should be a graphitic compound containing about five per cent of high-grade powdered graphite. This should be applied with a brush to the working side of the chain at least twice each week. When the chain becomes stiff and dirty it should be removed and thoroughly soaked in gasoline and the dirt blown out by means of an air-blast jet or steam jet.

Construction Industry News

Waukesha Motor Co., Waukesha, Wis., announces that H. L. Horning, President and J. B. Fisher, Chief Engineer, sailed November 9 on a six weeks' trip to Europe to confer with prominent internal combustion engine manufacturers such as H. R. Ricardo, K. J. E. Hesselman of the Hesselman Motor Corp., Ltd., and G. D. Boerlage of the Royal Dutch Shell Co.

The National Paving Brick Association, Washington, D. C., will hold its twenty-ninth annual meeting at Indianapolis, Ind., February 6, 7 and 8, 1935, at the Claypool Hotel. The sessions on February 7 and 8 will be open to the general public, to which anyone interested in street and highway development is invited. O. W. Renkert, Metropolitan Paving Brick Company, is President and George F. Schlesinger, formerly Director of Highways in Ohio, is Chief Engineer and Secretary of the National Paving Brick Association. There are six member companies manufacturing paving brick with plants located in the State of Indiana.

The Timken Roller Bearing Co., Canton, Ohio, has announced the appointment of Whitley B. Moore as General Manager of the Industrial Division. After three years' service in Pacific Coast sales, he was brought back to Canton in 1924 to take the position of Assistant General Sales Manager of the Industrial Division and in 1930 he was made Sales Manager which position he has occupied until his present advancement. John L. Young, until recently District General Manager in charge of the Pittsburgh Office, has been advanced to the position of Assistant General Manager of the Industrial Division at Canton. Harry D. Robb, who has been with the company since 1925, has been made District Manager in charge of the Pittsburgh Office. Harry H. Wood, who has been with Timken since 1929 has been appointed Manager of the Rolling Mill Division.

Link-Belt Co., Chicago, Ill., has announced the purchase of the physical assets of the Bailey-Burruss Mfg. Co., Atlanta, Ga. Link-Belt's Atlanta sales office is being moved to the Bailey-Burruss plant which will henceforth be known as the Atlanta Plant of the Link-Belt Co. The office will be headed by I. H. Barbee, who is being transferred from the Philadelphia plant of the company. He was formerly Link-Belt manager in Atlanta.

Hercules Powder Co., Wilmington, Del., has announced that, effective January 1, John K. McCabe, now assistant manager of the San Francisco office, will be an assistant director of sales with offices in Wilmington, and J. B. Johnson, for the past five years superintendent at Hercules, Calif., will be named to succeed Mr. McCabe as assistant manager of the San Francisco office.

Federal Motor Truck Co., Detroit, Mich., has announced the appointment of Don G. Furlong as District Sales Manager for the Ohio territory. For nine years he was associated with the Ford Motor Co. Sales Division and for the last five years was in charge of the Commercial Truck Division of the Dearborn Branch. In the spring of 1933, Mr. Furlong became General Sales Manager of the Thornton Tandem Co. from which position he has joined Federal.

Harnischfeger Corp., Milwaukee, Wis., held open house on November 17 for more than 1,000 visitors in celebration of the Corporation's 50th Anniversary and for a showing of the four 300-ton electric cranes built for the United States Government for installation at Hoover Dam in Boulder Canyon. These cranes with a 64-foot span and a lift of 70 feet are of the double-trolley power-house type with eight electric motors on the bridge drive alone, with a combined output of 410 horsepower for each crane. They will be used for handling the 600-ton hydro-electric rotor generators, the largest of their kind ever built. Another interesting feature of the program was the exhibition of the newest P & H models going at top speed on the test field adjoining the plant.

Toncan Culvert Manufacturers' Association, Youngstown, Ohio, has announed the appointment of H. N. Pickett as Advertising Manager. Mr. Pickett has been Advertising Manager of *Daily Metal Trade* for a number of years and his direct association with industrial advertising and publishing covers a period of more than twenty years.

Producing Aggregate for Fast Paving

(*Continued from page 22*)

Butler bulk cement plant was set up close to a steep hill so that a heavily-built platform from the top of the hill made it possible to deliver the cement direct to the top of the bin and leave the ground area free for the other trucks. One man with the driver of the cement truck handled dumping the cement and one man operated the batcher below. A supplementary hopper beneath the batcher made it possible for the batch man to weigh out two batches and have them ready for the trucks in quick succession. The cement batcher was located about 75 feet from the aggregate batchers.

With these well-planned aggregate production and bulk cement plants, the contractor delivered batches rapidly to the fleet of six Jaeger truck-mixers which poured an average of 4,500 feet of 10-foot slab 8 inches thick in 12 hours, with half-hour out for lunch. The operation of the truck-mixer fleet and the details of paving will be described in the January issue.

Paving Contractor Was Not Liable for Defects Developing After One Year

"That curbing which you constructed is going to pieces and we want you to replace it," complained city fathers to a paving company.

"We shall be glad to replace it if paid for doing so," replied the company. "If you will look at the contract under which the work was done, you will see that it requires us to make good any defects arising within one year after completion of the job. We made good all defects of which complaint was made by you within that time, and when the clock struck midnight on the 365th day, our responsibility ended."

It took a lawsuit to convince the city that the company was right in its position. The New York Supreme Court for Erie County said in the case of Town of Tonawanda v. Stapell, Mimm & Beals Corp., 264 N. Y. Supp. 424:

"If, as the plaintiff contends, the contractor became liable for defects which developed, or were discovered after the expiration of the year guaranty, then there was no occasion or necessity for incorporating into the specifications or contract the provisions quoted. They added nothing and limited nothing, and became idle words. We cannot think such was the intention of the parties. We construe the contract to limit the contractor's liability to the term of one year."

The court cites several decisions of other courts where similar conclusions were reached.

The Editor Comments

Personal Observations and Reflections

No Pig in a Bag Here—

When contractors were asked to bid on the Bills Brook Dam at Barkhamsted, Conn., a project which is nearing completion at the present time, they found both the dam site and the site of the borrow pits cleared. The Water Bureau of the Metropolitan District of Hartford County, Conn., spent $5,500 on this clearing to give the contractors a better break and not try to hide from them the actual ground conditions they would face if they were awarded the contract.

Isn't this much better than the game played by some of our state highway departments when bids are asked? They say to the contractor, "Here is a nice lot of excavation. There may be some rock in it but it is up to you to guess how much of this job will require drilling and blasting." The more adventurous contractor will take a chance that the rock will be only a small proportion of excavation and put a low unit price on "unclassified excavation." Sometimes he gets a break and finds there is only a small amount of rock but many time he loses out and finds a visit to the bankruptcy court necessary, and his bonding company finishes the job.

It is an expensive proposition for a contractor to study adequately a construction site. We feel that it is definitely the duty of any awarding agency to furnish as complete data as is physically possible as to the type of work to be expected, particularly in excavation, which comes closer to being "the pig in the bag" than any other form of general contracting.

We Must Not Slacken the Public Works Pace

"There is a feeling that the Public Works Administration will ask for further large amounts for public works. However, in view of what has happened in that field, the construction industry is apparently very definitely of the opinion that any such appropriation by Congress should be devoted to encouraging private construction rather than for additional public works."

Thus said, J. C. Bebb of New York, President of the Producers' Council, affiliated with the American Institute of Architects in an address at the eleventh semi-annual meeting of the Council in New York recently. Mr. Bebb speaks for a group primarily interested in building construction rather than representing the Construction Industry as a whole. It is very true that we need more private construction and this is coming through the various Federal agencies and insurance of bank loans for private building.

But do not forget that where PWA money has been used for non-federal projects it has been the means of stimulating recovery locally through direct employment and nationally through indirect employment and has produced concrete results. Where funds have been used for genuine public works and not merely to replace regular appropriations for the work of government agencies not engaged in construction they have fulfilled their mission. On with Public Works!

We'll Be Seeing You!

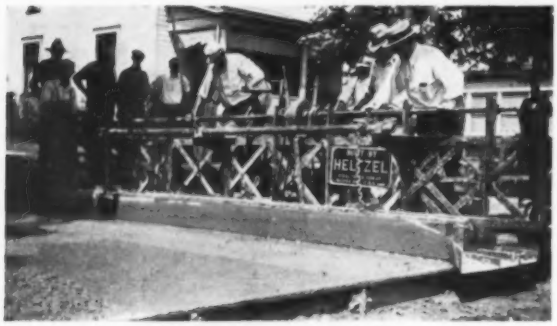
Au revoir and auf wiedersehen! With this issue CONTRACTORS AND ENGINEERS MONTHLY bids farewell to its present size. The magazine began with a page about half what it is today (58.6 per cent to be exact), outgrew those garments striving to fulfill its goal of "The National Practical Business Magazine of the Construction Industry," and attained its present size in 1928.

The growing pains have been acute for many months, the clothes have not fitted the demands of the growing 14-year-old book, so in January, 1935, the page size will again be doubled and, with the general appearance of a newspaper, CONTRACTORS AND ENGINEERS MONTHLY will present to you its best wishes for a prosperous year and the hope that you will enjoy its visits more than ever before.

The new style of the magazine will make it easier for you to read everything from the first page to the last. There will be lots more to read but easier to find, because the headlines will aid you, and we hope it will be even more helpful to you in making your work more productive through the ideas that will appear regularly in its pages. There will be helpful matter for everyone in the Construction Industry, engineering officials, contractors and manufacturers. Watch for the January issue of the new CONTRACTORS AND ENGINEERS MONTHLY.

In the meantime, have a mighty happy Christmas!

Theodore Reed Kendall



Here's the Machine Screeding in Reverse

Screeding Frontward and Backward

IT would save a lot of time and labor if a contractor could run his finishing machine with the screed down on the concrete running both backward and forward instead of having to lift the screed when he was going back. Screeding on both the forward and backward trip is just what was done by H. J. Wright, Superintendent for the Highway Department, on a State project on Route 30 at Minerva, Ohio, with a Flex-Plane screeding machine made by the Flexible Road Joint Machine Co., Warren, Ohio. He was building a 32 and 36-foot concrete road and screeded with this machine both forward and backward so that it was not necessary to lift the screed when reversing the machine. The first pass was made running forward in the usual manner and the second pass was made backwards which carried the necessary amount of concrete to fill all voids. It was not necessary for the pitmen to carry concrete back with shovels in the usual manner to fill the rough or scored spots. Heretofore, it has been necessary to do so in order to prevent the filling up of such spaces with mortar and water.

A New Lighter Steel Flooring for Bridges

THE general interest of state, county and municipal engineers in lighter weight bridge floors has brought about rapid developments in the armored type of slab. Truscon Steel Co., Youngstown, Ohio, has announced the I-Grid improved armored surfaced slab which combines the ordinary benefits of the reinforced slab with the advantages of greater lightness in weight and a surface of steel and concrete in diamond formation claimed to be the ideal arrangement for gripping tires and preventing skidding and protecting the concrete from traffic wear.

Installation of the unit is done by field welding in a simple manner which can be quickly done at low cost. The concrete can be placed without the necessity of using very fine aggregate and the exposed steel on the top surface is of sufficient width to insure reasonable contact with motor vehicle tires at the same time presenting sufficient surface contact to make the floor satisfactory even for heavy trucking. Heavy flanges on the top section give unusual stiffness before the concrete is placed so that substantial loads can be safely applied during construction.

The use of top and bottom flanges of equal area provide a section of practically equal resistance to positive and negative stresses, both with and without concrete filling and give the greatest possible stiffness under construction loading. The construction may be treated as armored concrete, in which event the combination of steel and concrete is established exactly. Or, as a group of I-beams enclosed in concrete, the full compressive strength of the top flange balances the full tensional value of the bottom flange.

The top and bottom lateral bars combined with diamond shaped armoring form the best possible arrangement for confining keying and locking the concrete with the steel. This insures a complete bond between the concrete and the steel and assures their acting as a combined unit. The wide bottom flanges form a substantial bearing surface upon which the concrete rests and produce an arrangement to resist punching action in the concrete.

The wider spacing of the reinforcing beams provides concrete members of sufficient width to insure proper distribution of stresses over the concrete and a compactness and uniformity in the concrete itself.

A Compact Heavy-Duty Shovel and Crane

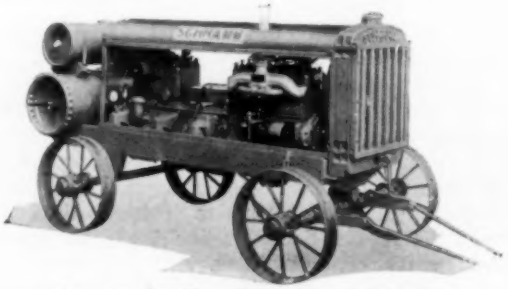
A NEW 2-yard heavy-duty shovel and 35-ton crane designated as Type 801 and furnished with gasoline, diesel, or electric power has been announced by the Ohio Power Shovel Co., Division of Lima Locomotive Works, Inc., Lima, Ohio. The builders state that its design embodies features that make low cost yardage possible. The design affords exceptionally short tail swing and only one car is required for shipment. The boom is of box type construction, electrically welded throughout.

The chain crowd is independent of other motions, the drums have extra large diameters, responsible for remarkable cable economy, the main machinery including cone rollers, is equipped with roller bearings. All gears are helical cut. The electric starter is within easy reach of the operator's position and is standard equipment. All major operations are independent, an important feature when the machine is used as a crane. The Type 801 shovel can be quickly converted in the field into a dragline or crane and when equipped as a dragline will effectively handle a 3-yard bucket.

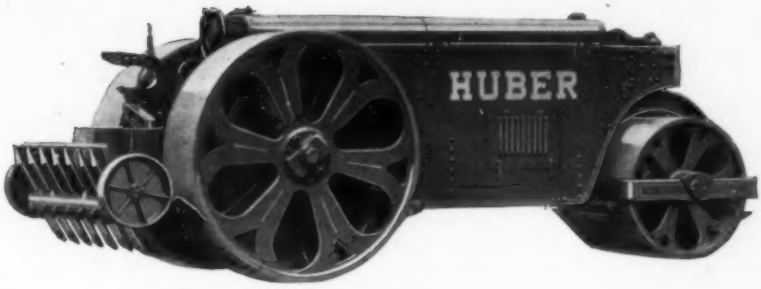
Two-Stage Portable Compressors in Five Sizes

A NEW two-stage compressor in which many parts are interchangeable with its single-stage compressor has been announced by Schramm, Inc., of West Chester, Pa. This permits the user to keep down the number of parts needed for servicing. High efficiency is secured by piping air from the first stage through a cross-flow type intercooler into the second stage which gives the air the final compression before entering the air receiver. This compressor eliminates many packings, pipings and fittings, giving a compact design.

The vertical, water-cooled design, standard on Schramm single-stage compressors, is used. The new two-stage compressors are built in 105, 160, 210, 315 and 420 cfm sizes with gasoline or diesel engine drive and are available in all types of portable mountings.



One of the New Two-Stage Compressors



The Huber Hydraulically-Controlled Road Roller

Hydraulically-Controlled Roller Sets New Pace

NO more cranking or spinning the hand wheel will be needed to steer or control the new roller which Huber Mfg. Co., of Marion, Ohio, has announced. The hydraulic power steer is practically effortless but can be changed instantly to hand steering which is desirable in working in tight quarters where the hand steer acts as a vernier to the power steer. The new Huber roller is a 6-cylinder 3-speed machine, powered with an industrial-type 6-cylinder engine developing 59 horsepower at 1,200 rpm.

Cylinder bore replacement in the engine is exact, easy and economical through the use of a dry removable cylinder sleeve through which water cannot leak into the crankcase. Precision engine bearings made it unnecessary to remove the engine from the chassis to replace the bearings. The forward and reverse clutches are self-adjusting. The low-pressure hydraulic system does away with leaky joints and blown out connections. Twenty-five roller and ball bearings carry every journal including the front and rear axles and king pins. The differential can be locked from the operator's platform, eliminating the old game of one man operating the roller while another inserted the lock pins in the rear roll hub.

The roller can be turned in a very short radius, due to its front arch construction making it possible to turn in an ordinary width of road by backing but once. The roller has a low center of gravity with more than three-fourths of the engine and transmission weight below the center of the rear axle. The Huber, which is only 6 feet wide, has 20-inch rear rolls and can operate at three speeds in both directions ranging from approximately ¾ to 6 miles per hour through governor control. The change from forward to reverse is instantaneous without shifting gears.

New Retread Mixer Discussed at Tulsa Road Oil Congress

THE new Etnyre Retread Mixer, which is not cumbersome or complicated and is lower in operating cost and maintenance was described by Arthur C. Rerick, Factory Representative, E. D. Etnyre & Co., Oregon, Ill., in his address before the National Road Oil Congress at Tulsa, Okla. He remarked, "The mixed-in-place method of black top road construction is becoming popular for other than main highways as it provides a serviceable and dustless road at a small portion of the cost of concrete and high type bituminous road construction.

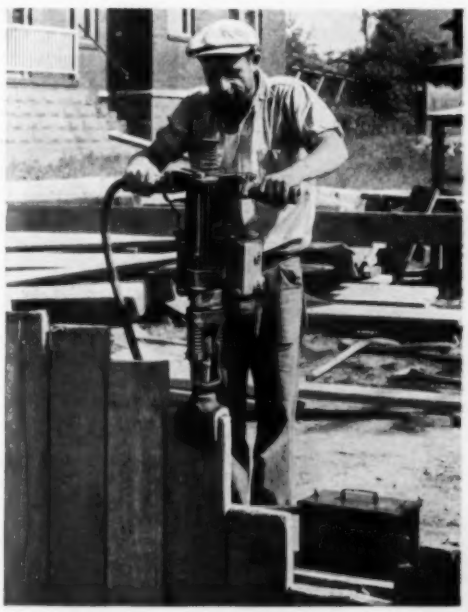
"The Etnyre machine mixes the material thoroughly—five times, then levels it, in each trip. The retread mixer blades are raised and lowered into position by a hydraulic hoist operated by an air cooled engine. Thus all the hard manpower work is eliminated. The blades raise and lower rapidly, and the leveling blade at the rear of the mixer is independent of the action of the wheels. The mixing blades span the depressions and level out the high spots in the base while the whole blade frame follows the average contour of the road base and the leveling blade, attached to the blade frame, produces a smooth finished surface. The outer blades are removable when transporting the mixer over the highway to the job, permitting rapid movement."

A Portable Gasoline Hammer

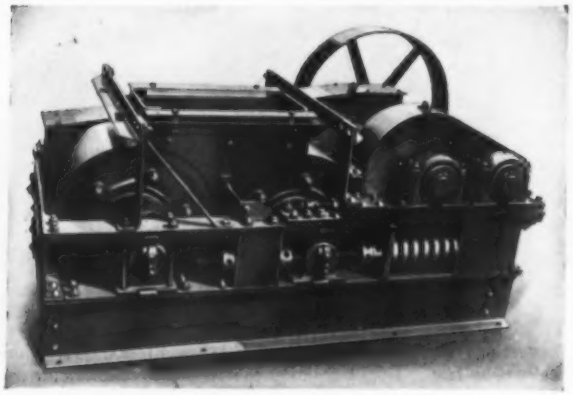
AN improved portable gasoline tool for breaking concrete, backfill tamping, digging frozen ground, rock breaking, driving sheeting, and general demolition purposes, is made by the Barco Manufacturing Co., 1801-1815 Winnemac Ave., Chicago, Ill.

The Barco is an air-cooled two-cycle single-cylinder gasoline-driven hammer which strikes approximately 1,500 blows per minute and will accommodate any standard 1⅛-inch hex shank tool. The tool is operated on low test gasoline. Lubrication is taken care of by mixing oil with gasoline and pouring in the gas tank. The normal consumption is one quart of the mixture per operating hour. The machine is started by throwing the "On" ignition switch and pushing down on the starting plunger at the top of the cylinder. A free floating steel piston acts as the hammer.

This hammer is easily operated by one man, weighs 89 pounds in the heaviest size, is unaffected by the weather and is easily assembled or dismantled.



A Barco Gasoline Hammer at Work Driving Sheeting



The New Western Roll Crusher

A New Roll Crusher for Fine Reduction Work

A NEW reduction roll crusher, built primarily to produce material from 1½-inch down to dust, although it will handle larger sizes, has been announced by the Austin-Western Road Machinery Co., Aurora, Ill. According to the manufacturer, it requires less power and since it operates faster, at 60 rpm, its capacity is increased.

The rolls measure 18 inches wide by 30 inches in diameter and are equipped with 2-inch removable, manganese steel shells. Each roll is supported by two large SKF self-aligning roller bearings that rotate on heavy stationary shafts. These bearings are located inside the rolls, close to the outer shaft supports, to materially reduce shaft load.

All crusher shafts, when operating under load, are subject to a certain amount of deflection which if not corrected will cause premature and excess wear or heating; such conditions cannot develop in this crusher because the bearings can not get out of alignment. Two heavy screws, heavy-spring equipped, permit any desired adjustment of the rolls and act as safety releases against tramp iron or other uncrushable material. The belt-driven pulley shaft is geared to the sprocket countershaft using heavy roller chain to operate the rolls. The chain drive permits a greater variation in the spread of the rolls, hence a greater variation of finished sizes. Gearing, sprockets and chain are fully enclosed with heavy metal guards and the roll crusher is equipped for Alemite lubrication throughout.

A High Capacity Well-Point System

THE drying up of excavation by means of wellpoint systems has added many dollars profits to contractors' bank accounts. Complete Machinery & Equipment Co., Inc., Webster Ave. & Hancock St., Long Island City, N. Y., has announced a new high capacity wellpoint system with a number of new features. Unlike older wellpoint systems, with Complete wellpoints, the contractor can buy the required 1½-inch riser pipe for connection with the header pipe system locally in any length or quantity desired. This constitutes a considerable saving in shipping time and transportation costs.

The outer cover of the wellpoint used for added protection consists of 20-gage perforated sheet brass. It covers the brass gauze strainer tube and the interior fluted tube of the wellpoint and is unusually hard and corrosion-resistant. Its outside diameter is 2 inches. The strainer tube is made of No. 60 brass gauze, and is soldered to the outer brass cover and both are easily removable as a unit. All that is required is to take out three bolts releasing the two half castings of the suction chamber. The strainer is then slipped off the inner fluted tube, and particularly after a salt water job, should be dipped in paint, allowed to dry for a few hours, and then replaced for continued use, or stored.

The fluted tube, covered by patents, provides for a maximum of effective drainage area, permitting a larger flow of water to the suction chamber in the jetting head and adding strength to the steel body of the tube. It is heavily coated with rust-resistant paint. No outside jetting apparatus is necessary with this wellpoint as each point is equipped with a self-jetting head. By applying water pressure through a hose at the top of the riser pipe to which the point has been attached, the jetting head is sunk quickly. The jetting head is made of malleable iron, heavily coated with rust-resistant paint.

When water pressure for jetting is applied, the ball check valve in the jetting head is forced off its seat permitting a flow downward. When jetting ceases, the ball rises and automatically seals the bottom of the point, preventing sand and gravel from being drawn up into the wellpoint. The header pipe is made in conveniently handled lengths of standard 6-inch steel tubing, with electrically welded inlets set approximately 3 feet apart. Steel couplings lined with rubber sleeves and tightened by two simple bolts are used to assemble the header line. No flanges or threaded fittings are employed which saves time in assembling, assures air-tight fit and unusual flexibility. The swing connection joining the riser pipes to the header system is available in all desired lengths and is movable in any direction.

Together with the wellpoint and header pipe set-up, the Complete pump rounds out the wellpoint system. Designed by experienced pump engineers particularly for this work, this pump has proved itself through long, hard service. Both its water and air capacity are ample and its sturdy construction, power and exclusive no-packing plunger are designed to assure uninterrupted, maximum service on 24-hour-a-day runs.

An Easily-Portable Trailer Compressor

EQUIPMENT which can be moved easily and economically from one job to another has become increasingly popular in these days of limited profits and scattered jobs. An addition to this type of equipment has been announced recently by Schramm, Inc., West Chester, Pa., in its new compact light-weight air compressor, known as the Utilty Type. It is mounted on a two-wheel pneumatic-tired trailer and can be transported at speeds up to 35 miles an hour by a car or truck. A trailer-type coupling is provided on the compressor drawbar, which provides a flexible connection, adaptable to sharp turns and rough roads.

Built in two sizes, these compressors are complete plants, with air receiver, radiator cooling systems, automatic unloading control, and are protected with a steel hood with side doors which can be padlocked. Drop leg supports serve to stabilize the compressor when it is in operation and can be swung out of position and locked when the machine is in transit. Model 25 offers 18 cubic feet actual air delivery and Model 55, 38 feet actual air delivery.

Showing the Ease and Simplicity with Which a Schramm Model 25 Utility Compressor Can Be Towed at 35 Miles an Hour

MORE GREASE MORE OIL MORE GREASE MORE OIL MORE GREASE

CHEAP GREASE and OIL WON'T STAY in THESE TRACTORS"

TAKE THE WORD OF THE MAN ON THE TRACTOR . . . TAKE THE RECOMMENDATION OF YOUR TRACTOR & EQUIPMENT DEALER

D-A LUBRICANT *and* D-A MOTOR OIL

SPECIAL FOR TRACTORS AND TRUCKS

Order FROM YOUR TRACTOR AND EQUIPMENT DEALER

Save 10% to 50% *on your* GREASE, OIL & PARTS BILLS

D-A LUBRICANT COMPANY, Inc. *Plant & Home Office* INDIANAPOLIS, INDIANA

A Hobart Electric Welder Mounted on a One-Ton Dodge Chassis Offers a Practical Service Truck for Contractors

A Truck-Mounted Electric Welder

A SERVICE truck on which is mounted a complete welding unit as well as a hydraulic hoist has been developed by the Sargent Machine Co., Fort Dodge, Iowa. A 1-ton Dodge chassis is used with a deck made up of flat steel and angles on which is mounted the Hobart electric welder just behind the cab with a Tex-Rope drive from the power take-off of the truck, with the drive controlled by a lever from the cab. The motor is equipped with a governor to keep the generator at the proper speed when welding with a heavy or light load.

The housing is built over the welder on the deck of the truck and holds tanks for oxygen and acetylene for cutting or welding, and a tool box and cable reel for the electric welder. The cab and housing are wired for electric lights taken direct from the welding generator through a rheostat.

The hydraulic hoist shown on the back of the platform is of 50-tons capacity and is driven from the welding generator by a double throw switch.

Form Ties That Break Inside the Wall

CONTRACTORS who are looking for a form tie that will hold a 3,000-pound load per tie, which are easily inserted through ¾-inch holes in the forms and which are easily broken 1 inch inside the wall, leaving only a small rod hole to be pointed, will be interested in the new "1-inch break" Snap-Ty announced by Richmond Screw Anchor Co., Inc., 243-253 Bush St., Brooklyn, N. Y. This combination tie and spreader consists of rods of the desired lengths with anchors welded in the center portion to prevent the rod turning within the wall beyond the breaking point of the Ty located 1 inch back of the wall surface. A special upset on the rod prevents the spreader washers from slipping along the rod to cause an uneven or incorrect wall thickness. The spreader washers are small enough to give positive spreader action, and to permit threading through the forms from the outside. The washers are loose on the rods so that the bonding of the concrete will not interfere with the breaking of the Ty 1 inch inside the wall. The distance from the washer to the end nut is the full thickness and varies according to the size of wales and uprights.

The forms are tied by slipping a gravity-type holder over the rod just inside the nut. After the concrete is poured, the holders are released by upward strokes of a hammer and then a wrench is placed on the Ty end and twisted to break the Ty at the weakened point 1 inch back of the surface.

THE ONE-INCH BREAK SNAP-TY FORM TIE AND SPREADER

A—Anchors to prevent turning, B—breaking point, C—upset to hold washers, D—spreader washers, F—form thickness, W—wall thickness

A 2,870-Pound 7-S Mixer

THE new 7-S Dandie mixer, mounted on four wheels, weighs only 2,870 pounds and with trailer mounting weighs only 2,950. These light weights have been accomplished through the use of high strength alloy steel. Drive is through a multiple V belt and the construction includes the re-mixing drum standard with all mixers of the Koehring Co., Milwaukee, Wis. The skip-flow shaker automatically shakes the skip along the natural flow line of the material causing it to clean quickly. Dandie mixers are full floating on springs which absorb operating and traveling shocks, reducing vibration and thus increasing the life of the machine.

Other features are construction for side discharge or end discharge, the automatic water tank and the ball bearing centrifugal auxiliary water pump which is self-priming and has a capacity of 25 to 30 gallons per minute at approximately 15 feet lift.

The New Koehring 7-S Dandie Trail-Mix

The Trail-Mix two-wheel type is only 73 inches wide, making it possible to spot it in congested quarters and its end discharge allows pouring direct to forms, sidewalks, alleys or floors in addition to all the possibilities of a side-discharge mixer.

Concrete Vibrator Powered with Gas Engine

A 2⅜-INCH by 18-inch concrete vibrator with a flexible shaft powered by a 2-hp gas engine makes up the new concrete vibrator made by Mall Tool Co., 7740 So. Chicago Ave., Chicago, Ill. By using this individual variable speed gasoline engine set, electric wires, generator sets and air compressors are eliminated. The vibrators are of the internal type and are immersed directly in the concrete. No special form work is necessary as there is no violent vibration of the forms.

Concrete vibration or placement with Mall vibrators permits less water and lower sand content as well as larger portions of coarser aggregate, giving more economical mixes. The shrinkage of concrete is materially reduced because of the higher percentage of coarse aggregate. Any depth of wall can be vibrated by adding suitable lengths of flexible shafting in units of 7 feet. Two additional lengths of flexible shafting, which is ample for the average wall job, makes the shaft length with the vibrator and engine shaft a total of 28 feet.

FOR MORE WORK MORE TRIPS AND GREATER PROFIT

THE GMC T-33 TRUCK IN THE 3-TON RANGE

Look where they will and compare as they wish, buyers of trucks in the 3-ton capacity range can make no better selection than the General Motors T-33. In every detail of its rugged make-up, this "engineered-for-the-job" money maker challenges on the score of downright value. *In fact, not one truck in its capacity range matches the T-33 on more than 3 of the 12 important counts that definitely assure greater performance, increased economy and longer life*—counts such as high sustained torque, frame stiffness, payload capacity and valve-in-head performance, to list but a few.

Pages could be devoted to a description of T-33 superiorities, but the most convincing way to judge its merit is to call in a General Motors Truck representative and ask to be shown the truck itself and the facts to prove why this staunch worker and earner is every inch an exceptional value at its comparatively low price—a far greater value than any other truck of comparable size.

● ***Whatever your hauling needs may be, there's a GMC truck or trailer to fit exactly—capacities range from 1½ to 22 tons.***

GENERAL MOTORS TRUCKS AND TRAILERS

GENERAL MOTORS TRUCK COMPANY
PONTIAC, MICHIGAN
Time Payments Available Through Our Own Y. M. A. C.

Cutting Off and Rolling Up the Asphalt from the Top of a Brick Pavement Which Had Been Treated with a Calcium Chloride Spray Before Squeegeeing the Asphalt Over the Surface and into the Joints

A Clean Surface for Brick Pavements Now Possible

ROAD builders have frequently complained of the objectionable appearance of brick pavements after the surface has been smeared with asphalt in squeegeeing the joint material between the bricks. A new technique now enables contractors and highway officials to produce brick pavements with a perfectly clean surface and tight asphalt joints. After the brick has been laid, Solvay calcium chloride marketed by the Solvay Sales Corp., 61 Broadway, New York City, is distributed over the surface in the form of a fine mist or spray by means of a simple hand sprayer. When properly sprayed vertically downward and not so as to strike the sides and edges of the brick, the calcium chloride covers the top surface completely but does not penetrate between the bricks. The asphalt is then poured on the brick while the calcium chloride is still wet and all joints are filled to the top.

As soon as the asphalt is dry, it is peeled or rolled off in sheets, leaving a clean surface brick with flush well-filled joints. The excess asphalt can be re-heated and used again, leaving practically no sediment to be cleaned out of the kettle and causing no foaming or bubbling.

According to George F. Schlesinger, Managing Director, National Paving Brick Association, a 35 per cent solution of calcium chloride with a 1 per cent starch content furnishes the best results.

Grease Packed in Cartridges

GREASES packed in cartridge form to fit a new type of grease gun are now being sold by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill. The cartridging of grease is a distinct innovation. To fill the new type of grease gun, the operator merely slips a factory loaded cartridge into the barrel of the gun which is then ready for use. The cartridges are made of one-pound capacity and include several grades of lubricant. This method of handling works equally well with fluid gear lubricant or fairly stiff grease. A partially used cartridge can be quickly replaced with another cartridge of different grade of lubricant, and the lubricant in the used cartridge, being enclosed, is not wasted and does not accumulate dirt.

This new system has been perfected by the Lubrication Corp., of Chicago, a concern owned jointly by the Standard Oil Co. of Indiana and Bendix Aviation Corp. Each cartridge has a sliding bottom which acts as a plunger to feed the lubricant into the high pressure chamber in the nose of the gun. Although the cartridges cannot be refilled, they cost only slightly more than the same amount of grease packed in ordinary containers. It is expected that cartridges of larger size may be offered in the near future.

A New Line of 7-S and 10-S Mixers

DESIGNED to insure thorough mixing combined with rapid handling of dry materials and mixed concrete, the new 7-S and 10-S mixers of the Knickerbocker Co., Jackson, Mich., will appeal to both engineers and contractors. The drum is of large diameter and the distance from opening to opening comparatively short. This shape keeps the aggregates together and permits larger openings for charging and discharging. The 60-degree loading skip is claimed to be the steepest ever offered and is made possible by the large charging opening. This combination facilitates rapid charging, and the elimination of skip pounding and shaking. The remixing action has been still further improved so that the materials are cut and folded by blades and carried by the buckets to the top of the drum, whence they are spilled onto the discharge chute which, in the mixing position, acts as a deflector, returning the mass to the charging side of the drum, for repeating the folding and kneading action. The wide discharge chute, in discharge position, assumes a 48-degree angle emptying the drum almost instantly. The low center of gravity on these machines makes for stability and the concealed and protected coil springs in the truck frame, with three-point suspension, absorb road shocks.

A New 2-Inch Self-Priming Centrifugal

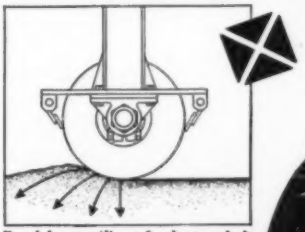
MODEL V-AS-2, a new 2-inch self-priming centrifugal pump has recently been announced by the Novo Engine Co., Lansing, Mich. This pump has a guaranteed capacity of 8,500 gallons per hour at a 10-foot head and may be had mounted on skids or on a two-wheel truck. It is powered with a Novo 2½-hp Model AG single cylinder engine, which is water cooled. The pump discharge pipe passes through the engine hopper, thus keeping the engine cooling water always at the proper temperature.

The pump has no packing, the seal being maintained by two leather seals on the impeller shaft. They require no attention. These seals have been used for over two and one-half years on Novo self-priming centrifugal pumps with no reported replacements.

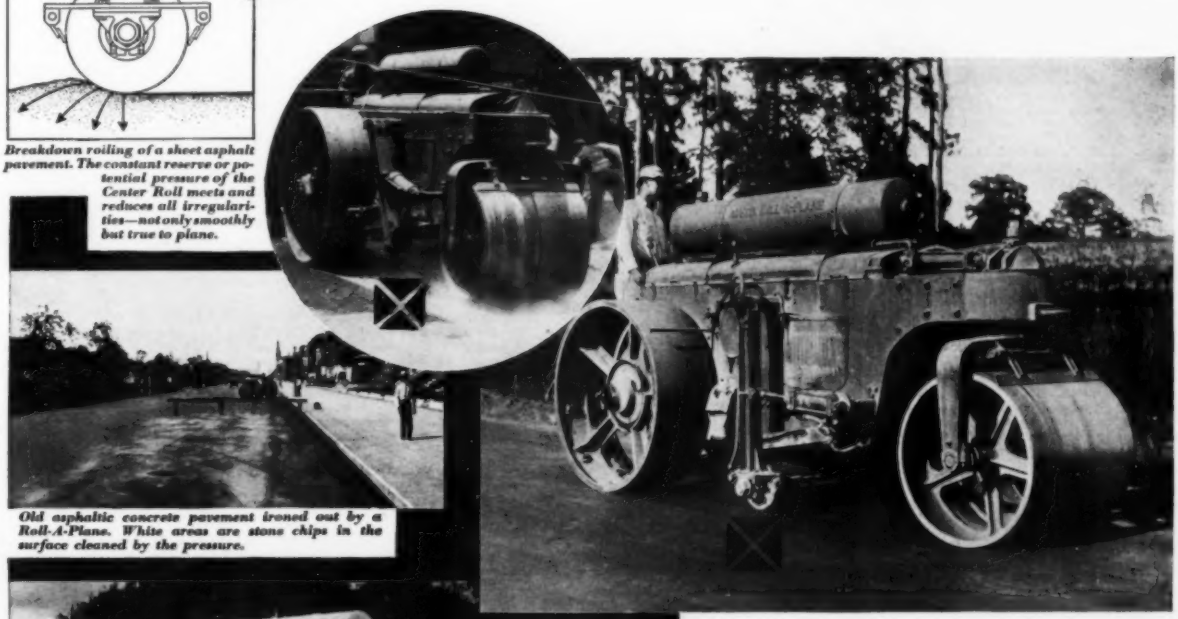
The New Novo Model V-AS-2 Self-Priming Pump

RESULTS . .

tell the spot-pressure story!

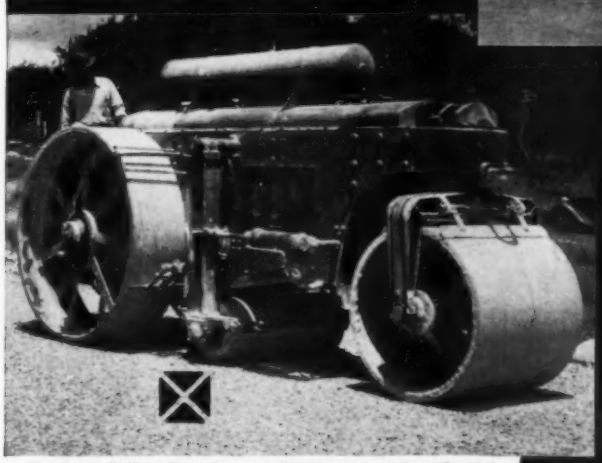


Breakdown roiling of a sheet asphalt pavement. The constant reserve or potential pressure of the Center Roll meets and reduces all irregularities—not only smoothly but true to plane.

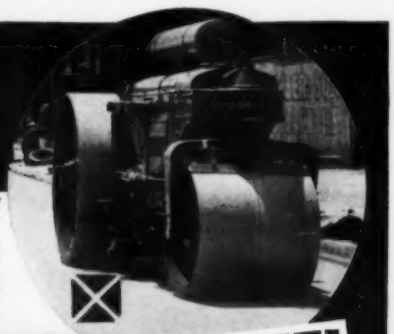


Old asphaltic concrete pavement ironed out by a Roll-A-Plane. White areas are stone chips in the surface cleaned by the pressure.

Entirely new performance from a road roller is demonstrated here in the finish rolling of a road-mix—a true plane surface without cross rolling, the remarkable result of the Center Roll principle.



The Center Roll is shown here on a bituminous macadam job which showed under final test a surface smoothness equal to the usual specifications for pavement of the highest type.



Finish rolling of sheet asphalt pavement.
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244 The Lincoln D. C. motor driven Model SA300, SA400 and SA600 welders, which are of arc-welded steel, drip-proof construction, completely assembled and mounted on a welded-steel four-wheel base with or without roller bearing running gear and steering handle, as desired, are described in literature which interested contractors may secure direct from the Lincoln Electric Co., Cleveland, Ohio.

A New Development in Bridge Floors

245 Greater strength with less weight features the new I-Grid steel flooring developed by Truscon Steel Co., Youngstown, Ohio, and which furnishes a non-skid surface which protects concrete from traffic wear, thereby prolonging the life of the floor and reducing the cost of repairs. Full details will be found in the latest Truscon literature.

A New Catalog of Contractors' Pneumatic Tools

246 The Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill., has announced the issuance of its new Catalog No. 40 on pneumatic tools for mining operations and for contractors. The catalog includes information on paving breakers, stopers, mountings, excavating, tamping and surfacing tools, sump pumps, etc.

A New 2-Inch Self-Priming Centrifugal

247 The Novo Engine Co., Lansing, Mich., has recently announced the new Model V-AS-2, 2-inch self-priming centrifugal pump which is described in a leaflet which may be secured from the manufacturer.

Asphalt Road Construction

248 Manual No. 1 of the Asphalt Road Construction Series, dealing with road-mix types and providing the essential information necessary to construct the various kinds of road-mix surfaces may be secured by interested contractors and engineers from The Asphalt Institute, 801 Second Ave., New York City.

An Easily-Portable Trailer Compressor

249 Bulletin 3403-CV, describing the new Utility Type compact lightweight Schramm air compressors, made in two sizes, and mounted on a two-wheel pneumatic-tired trailer for easy portability behind a car or truck, may be secured by contractors from Schramm, Inc., West Chester, Pa.

A Compact Heavy Duty Shovel and Crane

250 Bulletin No. 81 issued by the Ohio Power Shovel Co., Division of Lima Locomotive Works, Inc., Lima, Ohio, describes the new 2-yard heavy-duty shovel and 35-ton crane designed as Type 801 furnished with gasoline, diesel or electric power.

Concrete Vibrator Powered with Gas Engine

251 A 2¾-inch diameter concrete vibrator with a flexible shaft powered with a 2-hp gas engine makes up the new concrete vibrator which is described in a leaflet which may be secured from the Mall Tool Co., 7740 So. Chicago Ave., Chicago, Ill.

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Grease Packed in Cartridges

252 The Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill., has brought out a distinct innovation in packing greases in cartridge form to fit a new type of grease gun. Information on this system may be secured by writing to the manufacturer.

7S and 10S Mixers, No Skip Pounding Needed

253 The new Knickerbocker No. 7S and No. 10S mixers which are light in weight, fast working, durable, dependable, have the well-known Knickerbocker re-mixing action, have extra large diameter drums with large openings and a steep loading skip and other special features are described in a new illustrated folder just issued by the Knickerbocker Co., Jackson, Mich. A copy is yours for the asking.

More Tonnage in Drilling

254 A remarkable increase in tonnage is obtainable through proper drill operation according to the new Bucyrus-Erie bulletin describing the Bucyrus-Armstrong 29-T. This 20-page booklet states that because of its fast, powerful, cutting stroke, the 29-T can make substantial savings in rock preparation costs. The technique and economy of large blast hole operation is also described. A copy of this bulletin may be had by writing to the Bucyrus-Erie Co., South Milwaukee, Wis.

Crushing, Screening and Washing Equipment

255 The new general catalog No. 5000 issued by Traylor Engineering & Mfg. Co., Allentown, Pa., describes the well-known Traylor line of crushing, screening and washing equipment including jaw, reduction and gyratory crushers, portable gyratory, grizzlies and feeders, revolving screens, scrubbers for sand, gravel and stone, stone elevators and rolls.

A 4-Inch Diameter Concrete Vibrator

256 The new Vibro-Spade of the Vibro-Cast line made by Electric Tamper & Equipment Co., Ludington, Mich., operates on 110-volt 30-60 cycle alternating current, the vibrating unit is 16 inches long, 4 inches in diameter and weighs only 53 pounds. Complete information may be secured from the manufacturer.

Calling All Drills

257 Hardsocg Wonder Drill Co., 225 So. Benton St., Ottumwa, Iowa, has sent out a call to all users of Hardsocg Wonder Drills requesting them to report as to the satisfaction rendered by these drills. Send in your report to Hardsocg if you already use a Wonder drill and if not ask for the latest catalog on these sturdy jack hammers.

Recovering Crankcase Oil

258 Lubricating oils now drained from your trucks, tractors, etc., and discarded as useless, may be cleaned of all injurious contaminations with Skinner Stream-Line purifying equipment at a profit. This equipment is described in detail in literature which may be secured from Skinner Motors, Inc., 2231 Dalzelle St., Detroit, Mich.

Part 4 of the Story of Hoover Dam

259 Ingersoll-Rand, 11 Broadway, New York City, has just published a fourth bulletin describing the construction of Hoover Dam in Boulder Canyon. The present volume contains descriptions of the cofferdams, the aerial cableways, and the tunnels for the penstock headers, the penstocks, and the canyon wall outlets. Copies may be secured by writing to the company's main office and mentioning this magazine.

A New Roll-Type Crusher

260 Austin-Western Road Machinery Co., Aurora, Ill., has announced its Bulletin 1358 A.D. describing the new Western roll crusher No. 3018, designed especially for fine reduction crushing.

Diesel Power Units

261 Booklet 2462 issued by the Caterpillar Tractor Co., Peoria, Ill., tells power users how Caterpillar diesel engines are being successfully used by a large number of owners all over the world on all kinds of work and under all sorts of conditions. These engines, available in three sizes, can be supplied either as an engine alone or as a complete power unit mounted on a base. Booklet 2393 shows many of these units, "On the Job."

A High Capacity Wellpoint System

262 The Complete high capacity wellpoint system with special features in the riser pipe, outer cover, strainer tube, fluted tube, jetting head, ball check valve and header pipe is described in full in an illustrated circular which may be secured from the Complete Machinery & Equipment Co., Inc., Webster Ave. & Hancock St., Long Island City, N. Y.

New Retread Mixer

263 Complete information on the new Etnyre retread mixer for use in low-cost road surfacing, which is designed to mix the material thoroughly, and then level it in each trip, producing a smooth finished surface, may be secured from E. D. Etnyre & Co., 400 Jefferson St., Oregon, Ill.

Good Roads at Low Cost

264 The Barret Co., 40 Rector St., New York City, will be glad to send to interested contractors and engineers complete information on the use of Tarvia in the construction of good low cost roads, in resurfacing or widening old roads and in general maintenance.

(Continued on page 52)

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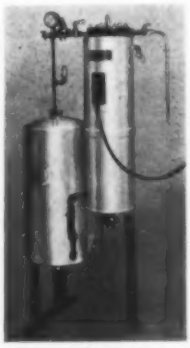

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(Continued from page 50)

Oil-Burning Engines for Construction Equipment

265 Blue Streak oil-burning engines and the features of oil-burning combustion are described in a folder which the Climax Engineering Co., 111 West Monroe St., Chicago, Ill., will be glad to send on request.

When It's Tough Digging

266 Complete information on the Koehring heavy-duty shovel which is designed for tough jobs, a feature of which is the shovel boom foot shock absorber which cushions all shocks and side strains at the digging end of the shovel, may be secured by interested contractors from the Koehring Co., Milwaukee, Wis.

An Answer to Dirt-Moving Problems

267 The Le Tourneau 12-yard Carryall scraper, which in heavy mud and winter conditions is moving 75 cubic yards an hour over a 1,400-foot round trip haul, is described in literature which those interested may secure upon request from R. G. Le Tourneau, Inc., Wilson Way at Roosevelt, Stockton, Calif.

Steam-Jacketed Asphalt Mixers

268 Hetherington & Berner steam-jacketed, steam-operated asphalt mixers for bituminous mixtures of all kinds, features of which are their compact design, welded steel construction, anti-friction bearings and adjustable and removable blade tips, are described in Bulletin MC-234 which Hetherington & Berner, Inc., Indianapolis, Ind., will be glad to send on request.

Road Rollers in All Practical Sizes

269 Complete information on Buffalo-Springfield road rollers, which are made in all practical sizes, 2½ to 17 tons, three-wheel and tandem, may be secured by interested contractors and engineers from the Buffalo-Springfield Roller Co., Springfield, Ohio.

Lubricants for Tractors and Trucks

270 D-A Lubricant Co., Indianapolis, Ind., will be glad to send to interested users of trucks and tractors complete information on its line of D-A lubricants, including the light for transmissions and differentials, the heavy for rollers, bearings and chassis, and the oil for the motors.

A Complete Line of Buckets

271 Williams multiple-rope, power-arm and dragline buckets, which are efficient, sturdy and economical, are described in bulletins which the Wellman Engineering Co., 7012 Central Ave., Cleveland, Ohio, will be glad to send on request.

Heat for Your Concrete Mixer

272 Littleford Bros., 485 E. Pearl St., Cincinnati, Ohio, will be glad to send complete information on Littleford Universal concrete heater units for tilting and non-tilting drum mixers, the use of which will go a long way to solve your winter heating problems.

An All-Purpose Truck

273 General Motors Truck Co., Pontiac, Mich., will be glad to send to those interested complete information on the General Motors T-18, a low-priced all-purpose truck of 2 to 3-ton capacity, which has a number of new and improved features.

A Fast Trailer-Mixer

274 Lansing Co., Lansing, Mich., will be glad to send to those interested specifications and prices on the Lansing 3½-T fast trailing and fast mixing trailer-mixer.

Cableways and Scrapers

275 Sauerman cableways for underwater excavation and Crescent scrapers for cutting down hills, digging canals or reservoirs, making fills, building levees and dirt handling are described in literature which Sauerman Bros., Inc., 464 So. Clinton St., Chicago, Ill., will be glad to send on request.

Roller-Bearing Jaw Crushers

276 The Telsmith-Wheeling jaw crusher, which is both a coarse and secondary crusher, a feature of which is the cylindrical roller bearing design which permits higher speed and larger output, is described in Bulletin W-34 which Smith Engineering Works, 4014 N. Holton St., Milwaukee, Wis., will be glad to send on request.

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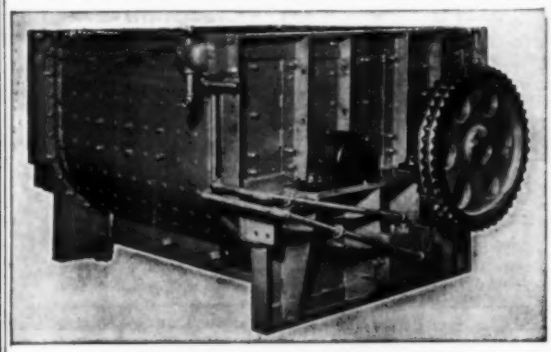

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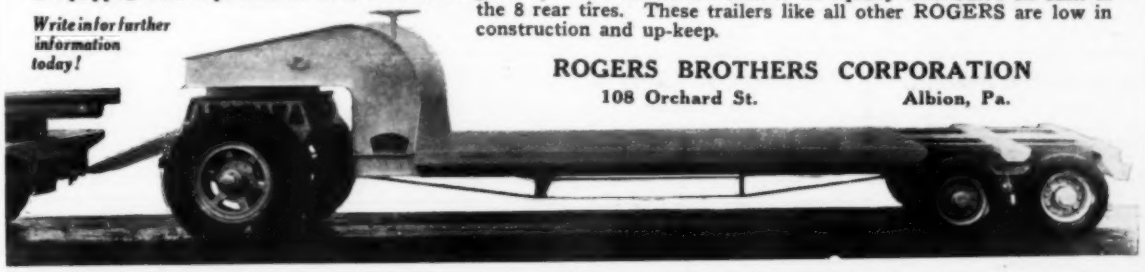

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Roads, Pavements, Bridges and Buildings, Inspections, Tests, Reports, Specifications, Design and Control of Concrete and Asphalt Mixtures.
1912 Linwood Ave. Toledo, O.

NEW YORK TESTING LABORATORIES
Chemical & Physical Tests, Microscopical Examinations
Electrical Tests, Power Plant Tests, Expert Inspections, Cities and Industries.
80 Washington St. New York City

OKLAHOMA TESTING LABORATORIES
Inspection—Testing—Analyses
Cement, Aggregates, Concrete, Steel Bituminous Mixers and Materials, Paints and Creosoted Timber, Waters, Etc.
1145 NW. Second St. L. D. 564
OKLAHOMA CITY, OKLAHOMA

PEASE LABORATORIES, INC.
Chemists—Biologists — Sanitarians — Water Analysts and Technical Field Consultants
39 W. 38th St. New York

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while reading over these pages do not fail to get in touch with us as soon as possible.

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Using Hayward Buckets exclusively is your best bet for making a profit on all digging and rehandling jobs.
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CONTRACTORS AND ENGINEERS MONTHLY
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UNIVERSAL CRUSHERS are used everywhere. A very full line enables the buyer to secure just the machine for his job. Skid crushers or complete plants in any combination with elevators, conveyors, bins and screens.

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Gives you daylight conditions on night jobs. Spreads a full, even beam of 8000 candlepower right where you need it.

Lights up the job for twelve hours on one 7-pound charge of National 14-ND Carbide and 7 gallons of water.

Is easily handled by one man; has nothing to get out of order; no harm done if it tips over—just stand it up again, and it goes right on working.

Weight 35 lbs. empty; 98 lbs. when full.

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NATIONAL CARBIDE SALES CORP.
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Opposite Grand Central

Asphalt Distributors Asphalt Kettles
Tool Boxes Oil Burners
Lead Furnaces
Emulsion Sprayers Surface Heaters

LITTLEFORD BROS.
485 EAST PEARL STREET
CINCINNATI, OHIO

CONSTRUCTION EQUIPMENT
McKIERNAN-TERRY
Pile Hammers, Pile Extractors
LAMBERT-NATIONAL
Hoists, Derricks, Cableways and Whirlers
STEELE & CONDICT
Special Machinery, Movable Bridge Machinery
Write for descriptive catalogs
McKIERNAN-TERRY CORP.
19 Park Row, New York
Distributors in Principal Cities

Contractors and Engineers Monthly

DIRECTORY OF EQUIPMENT DISTRIBUTORS

The following cards (arranged by states) show the names of dealers in contractors' equipment and supplies, with a record of the various lines handled. Canadian cards appear on page 65.

C. B. DAVIS ENGINEERIING CO

1000 43rd St. S. Birmingham, Ala.

Representing

ROBINS—Belt Conveyors and Screens
FOSTER-WHEELER — Pulverized Coal Equipment, Superheaters, Condensers and Boilers
BROWNING CRANE & SHOVEL CO.—Locomotive Cranes
ALDRICH—Power Driven Pumps
CLEVELAND — Overhead Electric Cranes
WHITCOMB—Locomotives
LO-HED—Electric Hoists

RONSTADT HARDWARE & MACHINERY CO.

"Pioneers in Good Merchandise"

TUCSON ARIZONA

BROOKVILLE Locomotives
BAY CITY Shovels
GALION Graders and Rollers
McCORMICK-DEERING Industrial and Crawler Tractors
McCORMICK-DEERING Diesel and Gas Power Units
STERLING Hoists
STERLING Portable Pumps
POMONA Turbine Pumps
MYERS Pumps
KIMBALL-KROGH Centrifugal Pumps

GARLINGHOUSE BROS.

2416 E. 16th St. Los Angeles, Calif.

Southern California Distributors for

RANSOME—Concrete Mixers, Pavers, Pneu. Placers, Grouters, Concrete Placing Equipment.
WORTHINGTON—Portable Compressors, Pneumatic Tools, Jackhammers, Pumps, etc.
DOMESTIC—Contractors Pumps
BROWNING—Truck Cranes, Shovels, Locomotive Cranes
BYERS—Crawler Shovels and Cranes
OWEN—Clamshell Buckets
OMAHA—Dragline Buckets
KOPPEL—Steel Tunnel and Sewer Forms and Cars
WHITCOMB—Gasoline, Diesel, Electric Locomotives
A. LESCHEN & SONS—Wire Rope
McKIERNAN-TERRY CORP.—Pile Hammers
LAMBERT-NATIONAL—Hoists and Cableways
DIAMOND IRON WORKS—Brushers and Portable Gravel Plants

Member: Associated Equipment Distributors

TURNER SUPPLY COMPANY

N. W. Corner of St. Louis & Commerce Sts.
MOBILE ALABAMA

Representing

McKIERNAN-TERRY CORP.—Pile Hammers
INDEPENDENT PNEUMATIC TOOL CO.—"Thor" Tools and Compressors
WILLIAMS—Clamshell and Dragline Buckets
ORR & SEMBOWER—Concrete Mixers & Hoists
AMERICAN STEEL & WIRE CO.—"Monitor" Wire Rope
DOMESTIC — Pumps and Hoists
M & M Form Clamps
WYOMING SHOVEL CO.—Red Edge Shovels, Scoops
LINK-BELT CO.—Crawler Cranes, Shovels, Loaders
WESTERN WHEEL SCRAPER CO.—Wheelers, Drags, Scrapers, Fresnos, Ploughs
BATES—Bar Tie
JAEGER-LAKEWOOD—Concrete Mixers, Paving Equip., Chuting Equip.
BEEBE BROS.—Hoists and Saws

ARKANSAS FOUNDRY COMPANY IRON AND STEEL

Little Rock Arkansas

Representing

AMERICAN STEEL & WIRE CO.—Wire Rope and Cable
NATIONAL STEEL FABRIC CO.—Wire Mesh
MILWAUKEE CORRUGATING CO.—Lath and Building Products
MAJESTIC CO.—Coal Chutes & Building Products
IRVING IRON WORKS—Subway Grating
CARTER BLOX-ON-END FLOORING CO.—Industrial Wood Flooring
LINDE AIR PRODUCTS CO.—Purox Welding and Cutting Equipment
DETROIT STEEL PRODUCTS CO.—Fenestra Steel Sash and Holorib Roof
SAINO MANUFACTURING CO.—Automatic Fire Doors, also
Structural & Reinforcing Steel & Steel Building Products

SMITH BOOTH USHER CO.

2001 Santa Fe Ave. Los Angeles, Calif.

Representing

BARBER-GREENE—Ditchers, Excavators, Loaders
CEDAR RAPIDS Crushers
CLEVELAND — Crawler Tractors
CLEVELAND—Rock Drills
EASTON—Industrial Cars
FREEMAN—Turntables
GALION—Graders, Rollers
HERCULES—Power Units
JAEGER—Mixers, Hoists, Pumps, Tower Equipment
JOHNSON—Bins, Hoppers
LAKEWOOD—Road Finishers, Forms, Chuting, etc.
LITTLEFORD — Asphalt Heaters
MacWHYTE—Wire Rope
MULTIFOOTE—Pavers
MUNDY—Hoists
NORTH STAR—Snow Plows
SAUERMAN—Cableway Excavators, Power Drag Scrapers
SCHRAMM — Compressors
TOLEDO — Torches
THEW—Shovels and Cranes
UNIVERSAL—"35" Shovels and Cranes
WALTER—4-Wheel Drive Trucks
WILLETT—Street Sweeper

Member: Associated Equipment Distributors

Arizona Tractor & Equipment Co.

138 So. First Ave. Phoenix, Ariz.

"CATERPILLAR" Tractors
"CATERPILLAR" Road Machinery
ATECO Dirtmovers, Bulldozers, Tamping Rollers and Scarifiers
ATHEY Truss Wheels
BUFFALO-SPRINGFIELD Rollers
CLEVELAND Rock Drills
DAY Crushers
HOUGH-UNIVERSAL Sweepers
KILLEFER Road Tools
LaPLANT-CHOATE Snow Plows
LITTLEFORD Asphalt Equipment
PACIFIC Wire Rope
LIMA Shovels
WILLIAMETTE-ERSTED Hoists
EUCLID Earth Moving Equipment
SCHRAMM Compressors
SMITH Mixers

BROWN-BEVIS EQUIP. CO.

49th St. & Santa Fe Ave., Los Angeles, Calif.

Amer. Saw Mill Machy. Co.—Saw Mill & Woodworking Mach
Barnes Mfg. Co.—Pumps
Briggs and Stratton Corp.—Engines
Buckeye Traction Ditcher Co.—Trenching Machinery
J. I. Case Co.—Industrial Tractors
Chain Belt Co.—Rex Mixers, Pavers, Pumps
Continental Motors Corp.—Gas Engines
Drake-Williams-Mount—"Omaha" Dragline Buckets
General Excavator Co.—Shovels
Geo. Haiss Mfg. Co.—Loaders
Huber Mfg Co.—Road Rollers
Ingersoll-Rand Co.—Air Compressors, Air Tools
Lidgerwood Mfg Co.—Hoists
The MacLeod Co.—Asphalt Heaters, Tools, etc.
Mallory Logging Equipment Co.—Blocks
Ohio Power Shovel Co.—"Lima" Shovels
Toledo Pressed Steel Co.—Torches, Horses

Member: Associated Equipment Distributors

EDWARD R. BACON COMPANY

Folsom at 17th St. San Francisco

Adnum Black Top Pavers
Bearcat Excavators
Burch Spreaders
Byers Shovels, Cranes
Cleveland Rock Drills
Cleveland Trenchers
Delsbie Derricks
Erie Tandem Rollers
Freeman Turntables
Hercules Power Units
Hypressure Jenny Cleaners
Hough Sweepers
Huber Road Rollers
Interstate Tramways
Iowa Crushers, Roadmix Pl.
Jaeger Mixers, Hoists, Pumps
Johnson Bins, Batchers
Jones Saw Benches
Klauer Snow Plows
Lakewood Road Finishers, Forms, Chuting
McKiernan-Terry Pile Hammers
Multi-Foote Pavers
Northern Conveyors
Page Dragline Buckets
Sacramento Oil Distributors
Schramm Compressors
Sun Ray Traffic Signals
Templeton Kenly Braces, Jacks
Toledo Torches
United 5-T Hd. Winches
Walter Four-Wh. Dr. Trucks
Wehr Motor Graders
Wiard Plows

Member: Associated Equipment Distributors

NEIL B. McGINNIS CO.

Box 2113 Phoenix, Ariz.
753 E. Jackson St.

Representing

Adams Leaning Wheel Graders
Allis-Chalmers Tractors
Barber-Greene Conveyors and Loaders
Brennels Rippers & Scarifiers
Buffy Back Fillers & Bulldozers
Erie Road Rollers
General Shovels, Cranes, etc.
Gardner-Denver Portable Compressors, Jack Hammers, etc.
Gurnee Spreaders
Huber Road Rollers
Jaeger Concrete Mixers, Pavers Pumps, Hoists
Jumbo Wheel Scrapers
Le Tourneau Heavy Grading Equipment
Lima Shovels and Draglines
Madsen Portable Paving Plants
Master Rotary Scrapers
Milwaukee Gas Locomotives
Morton Dirt Movers
Pioneer Crushing, Screening and Loading Plants
Snow King Rotary Snow Plows

CROOK COMPANY

2900 Sante Fe Ave. Los Angeles, Cal.

Southern California Distributors

Allis-Chalmers	—Tractors
Davis Mfg. Co.	—Hydraulic Scraper
Brennels Co.	—Scarifiers, Road Rippers, Implements
Osgood Co.	—Shovels, Cranes, Hoes
Buffalo-Springfield Co.	—Rollers
Heltzel Steel & Iron Co	—Bins, Batchers, Road Forms
Novo Engine Co.	—Engines, Hoists, Pumps
Morton	—Scrapers, Dirt Movers
Sullivan Machinery Co.	—Air Compressors
Mack Wooldridge Co.	—Backfillers, Bulldozers
D-A	—Lubricants

NORRIS K. DAVIS, INC.

400 Seventh St. San Francisco, Calif.

Representing

LE ROI CO.—Gasoline Power Units
MINNEAPOLIS STL. & MACHY. CO.—Twin City Engines
DAVIS CO.—Mixers, Hoists, Motor Truck Concrete Transfer Systems, Readymix Concrete Plants
DIAMOND IRON WORKS—Saw Mill, Rock Crushing, Screening, Conveyor and Transmission Machinery
HANSON CLUTCH & MACHY. CO.—Excavators
O. K. CLUTCH & MACHY. CO.—Hoists, Air Compressor
KEYSTONE DRILLER CO.—Shovels, Skimmers, Pulascoops, Well Drilling Machy., Tools

For Canadian Distributors, see page 65.

KRATZ & McCLELLAND, Inc.

522 Bryant St. San Francisco, Calif.

Northern California Distributors

Ransome Concrete Machy. Co.—Pavers, Mixers, Towers, Chuting
Novo Engine Co.—Engines, Hoists, Pumps, Lighting Units
White Mfg. Co.—Portable Asphalt Plants, Kettles
Greyhound—Contractors' Portable Saws
Heltzel Steel Form & Iron Co.—Bins, Batchers, Road Forms
Amse Iron Works—Gasoline Road Rollers
Union Iron Works Inc.—Pile Hammers & Foundation Equip.
Lidgerwood Mfg. Co.—Hoists, Winches, Cableways
N. P. Nelson Iron Works—Loaders, Conveying Equipment
The Gunitor Co.—Pneumatically-Placed Concrete
Wisconsin Fdry. & Mach. Co.—Crushers, Screens, Plants
C. R. Jahn Co.—LaCrosse "TU-WAY" Trailers

M. D. MOODY

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Jacksonville, Florida

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American Casting Co.
American Mfg. Co.
Buffalo-Springfield Roller Co.
Cyclone Fence Co.
The Elgin Corporation
E. D. Etnyre & Co.
De Walt Products Co.
Allis-Chalmers Mfg. Co.
Iowa Mfg. Co.
Chas. Hvass Co.
Littleford Brothers
Lakewood Engineering Co.
Mead-Morrison Mfg. Co.
Rawls Mfg. Co.
Page Engineering Co.
Freeman Mfg. Co.
Domestic Engine & Pump Co.
Hough-Universal Road Sweepers

O. T. CHRISTERSON CO.

122 So. Michigan Ave. Chicago, Ill.

Representing

KOEHRING COMPANY—Mixers, Pavers, Cranes, Shovel Dumpkors, Mud Jacks
KWIK-MIX COMPANY—Bituminous Mixers
BLAW-KNOX COMPANY—Forms, Ord Finishers, Bins, Batchers, Buckets, Truck Mixers
C. H. & E. MFG. CO.—Pumps, Saw Rigs, Hoists
INSLEY MFG. COMPANY—Concrete Towers, Chuting, Cranes, Shovels
PARSONS COMPANY—Trench Machines, Turbo Mixers
LE ROI COMPANY—Air Compressors
LITTLEFORD BROS.—Distributors, Tar Kettles, Heaters, Torches
CLEVELAND FORMGRADER CO.—Graders, Scrapers, Rooters, Form Graders, Straight Edges, Finishing Tools
CENTAUR TRACTOR CORP.—Mowers, Tractors

Wheelbarrow Scales—Burlap—Tie Bars—Hose—Concrete Carts

LOOK THIS DIRECTORY OVER CAREFULLY

If you find any errors while checking over this directory will you please advise us at once, because it is our desire to keep it accurate and up to date at all times.

CONTRACTORS AND ENGINEERS MONTHLY

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McDONALD TRACTOR EQUIP. CO.

2303 N. Orange Ave. Orlando, Fla.

Representing

Athey Truss Wheel Company
Austin-Western Road Mchy. Company
Chain Belt Company
Cleveland Tractor Company
GMC Truck Company
Killefer Manufacturing Company
Massey-Harris Company
Thew Shovel Company

PAUL COCHRAN EQUIPMENT CO.

228 N. LaSalle St. Chicago, Ill.

Representing

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Universal Crane Co.
Worthington Pump & Machy. Co.
Novo Engine Co.
The Knickerbocker Co.
American Steel & Wire Co.
Fairfield Engineering Co.—Conveyors
R. B. Equipment Co.—Power Subgraders

Used Equipment—Rentals

Power Equipment & Service Inc.

109 Water Street New Haven, Conn.

CONN. DISTRIBUTORS

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RODERICK LEAN Scrapers
OLIVER Implements
SARGENT and WALSH Snow Plows
CLETRAC Crawler Tractors
HART-PARR Tractors
MARLO Pumps
DETROIT Street Sweepers
CHICAGO Pneumatic Compressors
BROWNING CRANE & SHOVEL CO.

R. S. ARMSTRONG & BRO. CO.

676 Marietta St. Atlanta, Ga.

ALLIS-CHALMERS Tractors
AMES - BALDWIN - WYOMING—Shovels, Scoops
BEEBE Hand Hoists
BUTLER Bins
CARBIC Lights
CHICAGO PNEUMATIC Air Compressors
DOMESTIC Pumps
EMERSON Pumps, Valves
GALION Road Machinery
GENERAL ELECTRIC Motors
JAEGER Concrete Mixers
JONES-SUPERIOR Saw Rigs
LAKEWOOD Road Mach., Handling Equipment
LE ROI Engines
LIDGERWOOD Hoists
OWEN Buckets
SASGEN Derricks and Winches
SKILSAW Portable El. Saws
THEW Cranes, Shovels
UDDEHOLM Drill Steel
WATERLOO Bar Benders
WORTHINGTON Pumps

Member: Associated Equipment Distributors

SUPERIOR CONSTR. EQUIP. CO.

1850 South Kostner Ave., Chicago, Ill.

Chain Belt Co.—"REX" Pavers, Mixers, Pumps, Saw Rigs
Byers Mach. Co.—Cranes, Shovels, Draglines, etc.
Cleveland Rock Drill Co.—Rock Drills
Schramm, Inc.—Air Compressors, Tools
O. K. Clutch & Machy. Co.—Hoists
Heltzel Steel Form & Iron Co.—Forms, Bins, Mixing, Weighing, Batching Plants
Electric Tamper & Equip. Co.—Air & Electric Vibro Vibrators
Flexible Road Joint Machine Co.—Flexiplanes, Spreaders, Black-top Machines
Portable Machy. Co.—Conveyors
Freeman Mfg. Co.—Truck Turntables
Moritz - Bennett Corp.—Shoulder Machines
Huber Mfg. Co.—Road Rollers
White Mfg. Co.—Tar Kettles, Heaters, Distrs., etc.
Rogers Bros. Corp.—Trailers

National Distributors for the White Gas Vibrators

A Complete Line of Construction Tools and Equipment Carried in Chicago. Tel.: Crawford 6200

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110 S. Howard St., Baltimore, Md.

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Blaw-Knox Co.
Boston & Lockport Block Co.
Brookville Locomotive Co.
Byers Machine Co.
Chausse Oil Burner Co.
Connery & Co. Inc.
Domestic Engine & Pump Co.
E. I. Du Pont de Nemours & Co.
Dobbie Fdy. & Machine Co.
A. B. Farquhar Co. Ltd.
Harrington Co.
Lidgerwood Mfg. Co.
Pulsometer Steam Pump Co
Ransome Concrete Mach. Co.
Richmond Screw Anchor Co.
Sterling Wheelbarrow Co.
Templeton-Kenly Co. Ltd.
The Galion Iron Wks & Mfg. Co.
Union Iron Works
Universal Road Machy. Co.
Duff Mfg. Co.

YANCEY BROTHERS, Inc.

634 Whitehall St., SW Atlanta, Ga.

"CATERPILLAR" Tractors, Graders, Power Units, etc.
REX Pavers, Mixers, Saw Rigs, Road Pumps
P & H Cranes, Shovels, Draglines
BLAW-KNOX Forms, Bins, Buckets, Batchers etc.
BARBER-GREENE Ditchers, Conveyors, Loaders
HVASS Asphalt Distributors, Sweepers, Sprinklers
LITTLEFORD Asphalt Tools, Kettles
MUNDY Hoisting Equipment
BUFFALO - SPRINGFIELD Road Rollers
HOUGH-UNIVERSAL Sweepers
INGERSOLL-RAND Air Compressors, Tools
KILLEFER Road Ripper, Drag Scraper.
LaPLANT-CHOATE Crawler Dump Wagons, Bulldozers
McKIERNAN-TERRY Pile Hammers
WINSLOW Scales
CEDAR RAPIDS Crushers
DETACHABLE THURSTON Drill Steel and Bits
BAKER-MANEY Wheelers
WIARD Road Plows
EUCLID Wagons, Bulldozers
BALL Wagon Graders

Member: Associated Equipment Distributors

PEORIA TRACTOR & EQUIPMENT CO.

400 Franklin Street, Peoria, Illinois

Representing

Wisconsin Foundry & Mach. Co.
Caterpillar Tractor Co.
Allsteel Products Mfg. Co.
Athey Truss Wheel Co.
B. G. LeTourneau, Inc.
Speeder Machy. Corp.
Euclid Road Machy. Co.
Killefer Mfg. Corp.
LaPlant-Choate Mfg. Co.
Willamette-Hyster Co.
Gardner-Denver Co.
The Frank G. Hough Co.

Telephones—6177-6178

FARQUHAR MACHINERY CO.

Mill Supplies and Machinery

720 W. Bay Street Jacksonville, Fla.

Representing

AMERICAN "BOSS" Concrete Mixers
OXWELD Flare Lights, Welding Equipment
CRESCENT Saw Tables and Woodworkers
FARQUHAR Engines and Boilers
GOULDS-MYERS Power Pumps
JACKSON Wheelbarrows, Concrete Carts
LINK-BELT Chains, Sprockets, Drives
NOVO Gasoline Engines
NOVO Hoists, Single and Double Drum
NOVO Power Diaphragm & Road Pumps
PLYMOUTH CORDAGE CO. Rope and Twine
SASGEN Derrick Equipment
SILVERSTRAND Wire Rope and Accessories
TOLEDO Steel Torch Lights
STRUCTURAL STEEL Plain and Fabricated

Full Line of Industrial Supplies

F. H. BURLEW COMPANY

221-225 West Huron St., Chicago, Ill.

Telephone: SUPerior 5804

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BARNES—Pumps
BEEBE BROS.—All-Steel Hand Hoists
CONTINENTAL—Red Seal Gas Engines
HELTZEL—Bins, Batchers
INGERSOLL-RAND — Air Compressors and Tools
JONES-SUPERIOR — Portable Gas & Elec. Saw Rigs
LEACH — Concrete Mixers and Tower Equipment
M & M—Form Clamps
MEYER-HECHT — Adj. Shoes
NORDBERG—Track Shifters and Tunnel Shovels
WILLIAMS—Buckets, Trailers
WINSLOW—Scales
WYOMING — Red Edge Picks, Scoops and Shovels

McKIERNAN-TERRY CORPORATION
—Divisions—
McKiernan-Terry—Pile Hammers
Lambert-National—Hoists, Cableways
Steele & Condict—Spec. Machinery

BOWMAN-RALSTON TRACTOR & EQUIPMENT CO.

401 E. Florida St. Evansville, Ind.

Representing

Caterpillar Tractor Co.—Road Machinery and Harvester Machinery
Athey Truss Wheel Co.
LaPlant-Choate Mfg. Co.
Baker Manufacturing Co.
Thew Shovel Company
Killefer Manufacturing Co.
Schramm, Inc.—Compressors
Willamette-Hyster Co.—Hoists
Pioneer Gravel Equip. Mfg. Co.
Anthony Company

Standard Equipment & Supply Corp.

Successor to
McLaughlin Mill Supply Co., Inc.
834 Michigan Ave. Hammond, Ind.

Representing

JAEGER Plaster, Mortar and Concrete Mixers, Pumps, Hoists, Lakewood Towers and Mast Plants
MARION—Steam Shovels and Cranes
GOULD—Pumps
CYCLONE—Fence
LEROI—Engines
BATES—Tractors
CASE—Industrial Tractors
TOLEDO—Wheelbarrows Concrete Carts
SAUGEN—Derricks
ROEBLING—Cable
ERIE—Buckets and Bins
MULTIFOOTE—Pavers
BALDWIN—Shovels
TOLEDO—Torches
STOCKLAND—Graders
SCHRAMM—Air Compressors

All Kinds of Used Equipment

ROY C. WHAYNE SUPPLY CO.

Cor. 8th & Main Sts. Louisville, Ky.

Representing

Caterpillar Tractor Co.
Jaeger Machine Co.
Heltzel Steel Form & Iron Co.
Barnes Manufacturing Co.
Davey Compressor Co.
Hardsocg Wonder Drill Co.
Chicago Automatic Conveyor Co.
Northwest Engineering Co.
Euclid Crane & Hoist Co.
Athey Truss Wheel Co.
LaPlant-Choate Mfg. Co.
Good Roads Machinery Corp.
New Holland Machine Co.
Timken Roller Bearing Co.—Rock Bits
Cleveland Rock Drill Co.

ALBAN TRACTOR COMPANY, Inc.

725-27 East 25th St. Baltimore, Md.

"CATERPILLAR" Diesel Tractors, Motors
"CATERPILLAR" Road Machinery
"CATERPILLAR" Combine Harvesters
GENERAL Excavators
GRAVELY Power Mowers, Plows
KILLEFER Tillage Tools
LINK-BELT Shovels & Cranes
EUCLID ROAD MACHINERY CO.
CLEVELAND ROCK DRILL CO.
BARNES MFG. COMPANY
LA PLANT-CHOATE MFG. CO. BABCOCK MFG. CO.
WILLAMETTE-ERSTED CO.
BAKER MANUFACTURING CO.
ROTARY SNOW PLOW CO.
ATHEY TRUSS WHEEL CO.
REX-WATSON CORPORATION
DAVEY AIR COMPRESSOR CO.
BLAW-KNOX Bulldozers, Dirtmovers

INDIANA EQUIPMENT CO., INC.

327-29 West Market St. Indianapolis, Ind.

Representing

ATHEY TRUSS—Wagons, Bulldozers
BUFFALO-SPRINGFIELD—Rollers
"CATERPILLAR"—Road Machinery
"CATERPILLAR"—Tractors
EUCLID—Wagons, Scrapers, Bulldozers
GENERAL—Shovels and Cranes
INGERSOLL-RAND—Compressors Tools
LaPLANT-CHOATE—Wagons, Scrapers, Bulldozers
LIMA—Shovels and Cranes
NIAGARA—Vibrating Screens
OWEN—Clam Shell Buckets
OMAHA—Dragline Buckets
PAGE—Dragline Buckets
SAUERMAN—Cableways, Power Scrapers
UNIVERSAL—Crushers, Pulverisers

Joe C. Tucker

Morganfield Kentucky

Representing

Austin-Western Rd. Machy. Co.
Cleveland Tractor Co.
Western Wheeler Scraper Co.
Harnischfeger Corporation
Lakewood Engineering Co.
A. B. Farquhar, Ltd.
Chain Belt Co.
Link-Belt Co.
Sullivan Machy. Co.
Butler Bin Co.
Euclid Rd. Machy. Co.
Hughes-Keenan Co.

D. C. ELPHINSTONE, INC.

115 S. Calvert St. Baltimore, Md.

Representing

Koehring Co.
Kwik-Mix Co.
Insley Mfg. Co.
Parsons Co.
C. H. & E. Mfg. Co.
Geo. Haiss Mfg. Co.
Sauerman Bros., Inc.
Allis-Chalmers Mfg. Co.
Beaumont Birch Co.
Gardner-Denver Co.
Linn Mfg. Corp.
Owen Bucket Co.
LaBour Co., Inc.
Emerson Pump & Valve Co.
Iowa Mfg. Co.
H. K. Porter Co.
Reed Prentice Corp.
Truscon Steel Co.
McKiernan-Terry Corp.
Lambert-National Hoists
Goodall Rubber Co.
Minwax Co.
E. D. Emyre & Co.
W. A. Riddell Co.
Hough-Universal Sweepers

Member: Associated Equipment Distributors

GIERKE-ROBINSON CO.

4th & Ripley Sts. Davenport, Iowa

Representing

BUCYRUS-ERIE—Cranes, Shovels and Draglines
BLAW-KNOX—Steel Road, Curb and Gutter Forms, Bins, Batchers, Clamshell Buckets, Truck Turntables, etc.
CHAIN BELT—Mixers, Pavers, Pumps, Saw Rigs, Conveyors, Elevators.
CLYDE—Gasoline and Steam Hoists, Derricks
HOUGH-UNIVERSAL—Sweepers
JAEGER—Mixers, Pumps
A. W. FRENCH—Ord Concrete Road Finishers
SULLIVAN—Air Compressors, Tools
TRACKSON—Crawlers, Shovels and Bulldozers
McCORMICK-DEERING—Industrial Tractors

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D-A Lubricants, Oils
Hewitt Belting, Hose
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GALION Graders & Maintainers
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LITTLEFORD BROTHERS Asphalt Equipment
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SULLIVAN MACHY. CO. Compressors & Tools
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GARDNER-DENVER Air Compressors
F. W. D. Trucks
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KILLEFER Scrapers
BYERS Shovels and Cranes
MACWHYTE Wire Rope
GENERAL Wheelbarrows, Scrapers and Blades
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WILLIAMS Buckets and Trailers
ATHEY TRUSS WHEEL Wagons
DOMESTIC Pumps & Hoists
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Huber Mfg. Co.
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Production Equipment Co.
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Austin Manufacturing Co.
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Hercules Motors Corp.
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DROTT Bulldozers, Scarifiers, Scrapers, Eliminators
HOUGH-UNIVERSAL Sweepers
WAUSAU Snow Plows
OSHKOSH 4-Wh.Dr. Trucks
DAVEY Air Compressors
KINNEY Road Oilers
TORO Highway Mowers
HERCULES Road Rollers
LA CROSSE Tu-Way Trailers
CLEVELAND Rock Drills
WILLETT Truck Bladers
HANDY SANDY Sand Spreaders
NOVO Pumps, Hoists, Eng.

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make this Directory of Dealers in construction equipment the most complete and accurate of its kind. Therefore, we would greatly appreciate any suggestions or corrections that you may have to offer.

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Detroit Graphite Co.
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Faie-Root-Heath Co.
Climax Eng. Co.
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Le Roi Co.
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M. & M. Wire Clamp Co.
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Saugen Derrick Co.
Sheldon Mfg. Co.
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Bates Wire Ties
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Buffalo-Springfield Co.
Burch Corp.
Chain Belt Co.
Clyde Iron Works
Euclid Road Machy. Co.
Godfrey Conveyor Co.
Killefer Mfg. Corp., Ltd.
Lyon Iron Works
Pacific Marine Supply Co.
Pulsometer Steam Pump Co.
R. B. Mfg. Co.
Saugen Derrick Co.
Sauerman Bros.
Smith Engineering Works
Sterling Wheelbarrow Co.
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Syntron Co.
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Member: Associated Equipment Distributors

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Koehring Div., Parsons Div., Kwik-Mix Div.
Schramm, Inc.
American Tractor Equip.
Lenhart Wagon Co.
Sterling Machinery Corp.
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Master Equipment Co.
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Miami Trailer-Scraper Co.
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Highway Trailer Co.
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Insley Manufacturing Co.
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C. H. & E. Mfg. Co.
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Goodyear Rubber Co.
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Diamond Iron Works, Inc.
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R. HOOD HAGGIE—Steel and Wire Cable
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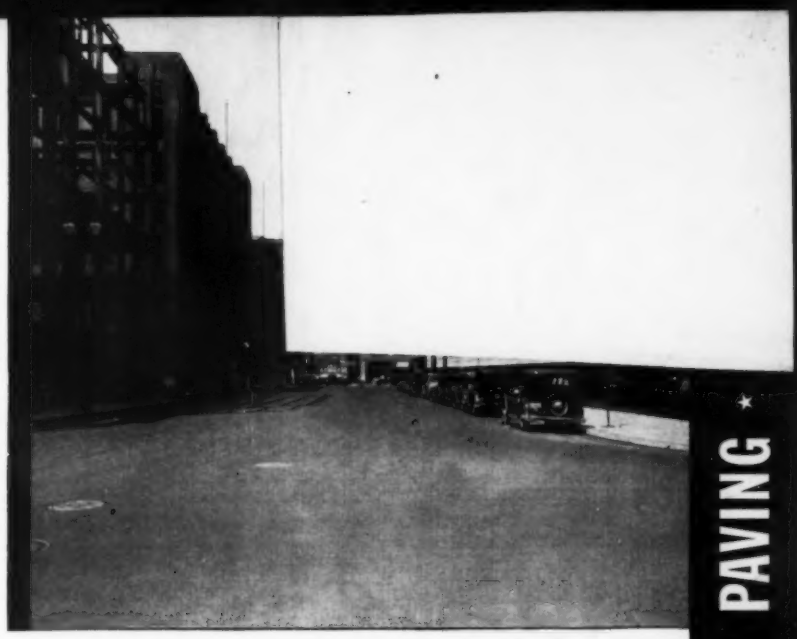
In the new and larger Public Works program which is being considered by the Administration, it is hoped that a revision of the law and regulations under which current work is being carried out will also be given consideration. Many existing provisions are not in the interest of economy. For example, the limitation of 8 hours per day and 30 hours per week per employee in the unskilled class is a distinct detriment to the employee. Further, limiting employment to the political subdivision in which the work is being done is ill-advised and accomplishes no sound economic results.

West side of Livernois between Davison and Oakman Streets.

Wayne Street, in the heart of "downtown" Detroit

Davison Avenue between Linwood and Livernois.



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Livernois between Fenkell Avenue and McNickols Highway.

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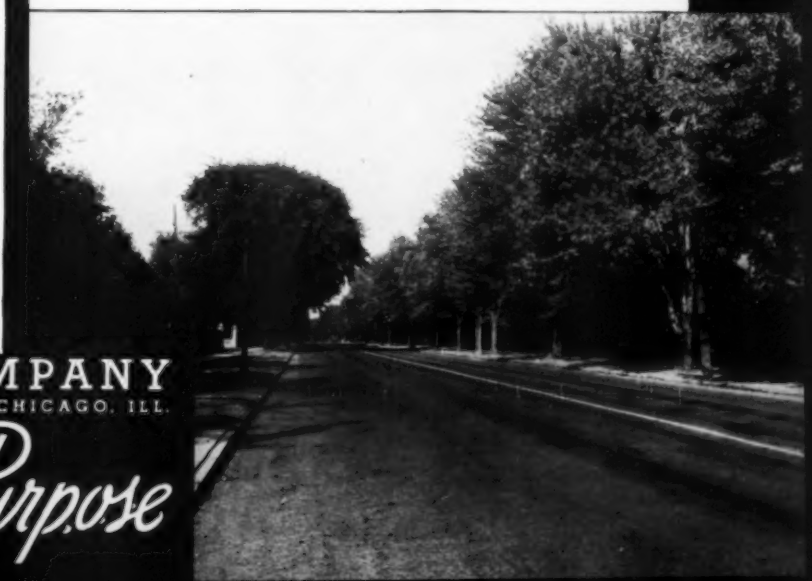

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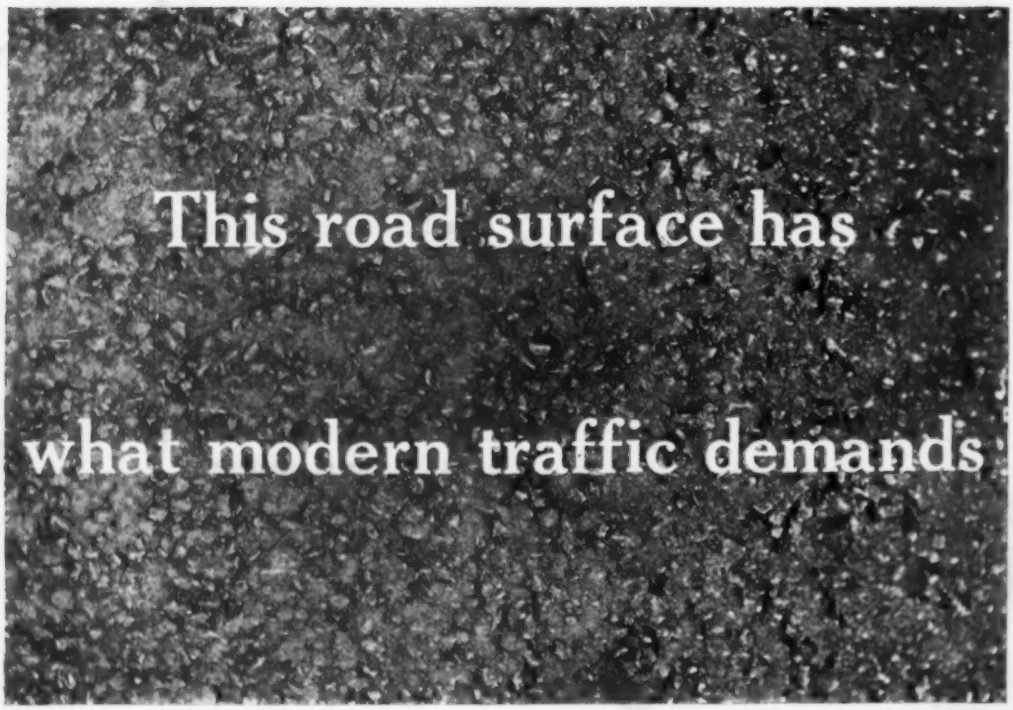
910 S. MICHIGAN AVE. (Indiana) CHICAGO, ILL.

Asphalt for every Purpose



Six miles of Montcalm-Kent County, Mich. highway between Greenville and Sparta have been surfaced with this type of TEXACO Asphalt construction. The gravel foundation received first a prime coat of Cutback Asphalt. An Asphaltic Concrete binder course, two inches thick, was then laid, followed by a one inch wearing surface, also of Asphaltic Concrete.

Because it is resilient and suffers no loss of efficiency due to changing temperatures, this type of TEXACO Asphaltic construction will give years of service. The same qualities also insure minimum maintenance.

TEXACO

THE TEXAS COMPANY
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